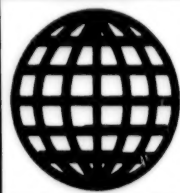


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**FOREIGN
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JPRS Report

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Science & Technology Europe

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ADVANCED MATERIALS

Germany: AKZO Develops Plastic Film With Memory Capacity

92MI0663 Bonn DIE WELT in German 30 Jul 92 p 7

[Article by Norbet Lossau: "Yellow Plastics Sheet With Memory—Many Different Potential Applications—From Microfiche to Rewritable Data CD"]

[Text] Dr. Robert Jan van Wijk from the research laboratories of Akzo in Arnhem holds in his hand a square piece of plastics sheet. It is a dull yellow color and opaque. The fact that this is a material with truly extraordinary properties becomes clear once Wijk holds the sheet over a hotplate—the sheet immediately becomes as clear as glass and transparent. This transparent state is preserved by cooling the sheet rapidly in a water bath; slow cooling, on the other hand, makes the sheet yellowish again and opaque to light.

The EC would not have promoted the development of this effective sheet with funds from its research budget if the material were not also suitable for useful applications: the yellowish sheet is ideal for use as a rewritable memory for analog and digital data. The Akzo researchers have reported on these potential applications recently at an EC conference in Seville.

When the sheet is used as a data memory, certain preselected areas of the sheet are heated with a fine laser beam. The sheet then becomes opaque in these places and is then cooled to room temperature so rapidly that the transparency remains intact. Pictures, text, technical drawings, and any other analog data can be written onto the sheet with a laser beam. Akzo project leader Dr. Gustaaf Moehlmann is initially thinking of using the writable plastics sheet as a substitute for the still widely used microfiche.

With a microfiche, the information to be stored is mapped onto a film with the aid of conventional light optics, and the film then has to be developed chemically. The new material has some advantages in this respect: the laser beam can be computer-controlled to expose the plastics film in the same way as a laser printer, so that drawings from the computer memory can be recorded directly on the sheet. No chemical developing process is required, the sheet is not sensitive to daylight and the data carrier can be erased by heating and slow cooling and then written on again.

On the other hand, if only individual spots are exposed with the laser, data can also be stored in digital form on the sheet, as with a CD. A comparatively simple and inexpensive technical solution for replayable music or data CDs is thus beckoning on the research horizon.

The Akzo researchers are already mastering the production of strips of the yellow sheet up to 100 meters long. The laser beam can write them later at a speed of up to

8 meters per second, thereby producing structures with a resolution of about five-thousandths of a millimeter.

The secret of the memory sheet lies in special molecules which were cobbled together by the Dutch researchers from certain organic polymers and so-called liquid crystal molecules. These stretched molecules can be oriented parallel to one another or they can be totally disordered. In the first case they appear transparent, and in the second case milky yellow. At certain temperatures there is a sudden transition between these two states.

The change from "translucent" to "opaque" is also used with the liquid crystal displays on wristwatches or the monitors of laptop computers. It is crucial for the usefulness of the new sheets, however, that the change-over to the transparent state takes place at relatively high temperatures above 100°C. The data can thus "survive" undamaged for many decades at room temperature.

AEROSPACE

Airbus Seeks Rapid Certification for A330

92WS0610A Stuttgart FLUG REVUE in German
Jun 92 pp 18-21

[Article by Volker K. Thomalla]

[Text] As the second example of the Airbus Industrie double program, the twin-jet A330 follows the four-jet A340 to the take-off runway. Final assembly of the first A330 will take place in Toulouse, and it is due to make its first flight in October. For the ETOPS certification of the aircraft Airbus will also use A340 data.

Before a twin-jet aircraft is allowed to fly long distances over water or over deserts, it must have demonstrated that it is reliable. International regulations like the European JAA AMJ120-42, or national ones like the American FAA Advisory Circular 120-42A, or the Canadian regulation Transport Canada TP 6327, stipulate this. Summarized briefly, these documents say that twin-jet planes may only fly routes over which an alternative airport may be reached within a maximum of 60 minutes. That is, unless the engine assembly of the aircraft has a special certification known as ETOPS [Extended Range Twin Engine Operations].

At the present time approximately every third flight over the North Atlantic is carried out according to ETOPS rules, and the experiences derived from this have been positive in every respect. The airlines utilize the greater economy of the twin-jet aircraft, which through ETOPS are allowed to take more direct and shorter routes over the big pond, which previously were reserved solely for planes with three or four engines. ETOPS certifications are given for flight times to the alternative airport of 75, 90, 120, and 180 minutes. For this, several conditions have to be met: 1. The aircraft must satisfy heightened safety requirements, and along with other additional equipment must have three or more independent power

sources, as well as a fire-extinguishing system for inaccessible rooms on board the plane. 2. The airline must have demonstrated its experience and reliability in air traffic. 3. The engine must have proved itself through at least a quarter of a million hours of operation.

With a new model of aircraft these requirements do not normally have to be fulfilled right away. Proof of reliability can also be obtained by means of so-called technical transfer analysis. This means that components or systems which are already being flown in other models may be used as proof. Thus in the application of Airbus Industrie for ETOPS certification of the A330, its great similarity in construction to the A340, which was already in service, was useful. In the A330 and the A340, for example, the automatic pilots, the hydraulic systems, the landing gear, and the communication systems are up to 100 percent identical. The fuel system has a 90 percent commonality, while the electrical system is only 30 percent identical. And since the propulsion system for the A330 was derived from units which were already being flown, empirical values can also be adopted in this case—which can result in an abbreviated ETOPS certification procedure.

Before this, however, the first A330s must be finished. The components for the A330 and A340 are manufactured through fast work at the partner firms of the Airbus Consortium. Deutsche Airbus (DA) manufactures the forward and rear fuselage sections, the tail tip, the landing flaps, and the rudder assemblies. The wings come from British Aerospace, while the Spanish firm CASA manufactures the horizontal tail units and the forward entry doors. Finally the French Airbus partner Aerospatiale builds the cockpit section and the middle fuselage section. The components are then flown from all parts of Europe by Super Guppies to Toulouse for final assembly, which is the responsibility of Aerospatiale. Beginning in October Antonov An-124s of the Air Freight Company Heavy Lift Volga-Dnieper will assist the Super Guppy fleet in this task, and will transport the A330 and A340 wings from Manchester to Bremen for outfitting, and from there to Toulouse for final assembly.

The A330 will be assembled by Aerospatiale in the Clement-Ader Hangar in a joint assembly line along with the A340. In February and March the components for the assembly of the first A330 arrived. The plane will be the 10th aircraft to be assembled on the new final assembly line (although it has the serial number 012).

At the end of March the new aircraft left the hangar for the first time on its own wheels, in order to be hauled from one work station to the next. There the two General Electric CF6-80 engines will presently be installed, having previously been fitted out with casings and thrust reversal by Rohr Inc. In a nearby commercial district Rohr Inc. operates a factory where this work is carried out.

The interior outfitting of the aircraft takes place in a nearby hangar, and not, as originally planned, at DA in

Hamburg. DA has instead taken over the final assembly of the A321. Production of the two aircraft models of the Airbus double program is rapidly getting underway. In 1993, 39 A340s and six A330s will be built. In 1994 according to present plans it will be 30 A340s and 38 A330s, until in 1995 the maximum production rate of 77 aircraft per year, (40 A330s and 37 A340s), will be reached. Full utilization of production capacities is ensured for the first years, since the order book shows 258 orders for the A330 and A340. The greater part of the orders, covering 143 units, are for the A330. Further development of the A330 is intended. The maximum take-off weight will first be increased from 212 to 223 tons. The next step will be an extension of the fuselage from its present 63.7 m (A330-300) to 70 m (A330-400X). This would increase the carrying capacity of the aircraft from 335 to 380 passengers—a feature which is especially in demand by Asiatic airlines, and will further increase the sales prospects of the A330 in this growth market.

Six aircraft will participate in the A330 flight test program. The first A330s, with the serial number 012—which are equipped with General Electric CF6-80E1 Turbofans—will take off on their maiden flights in October of this year. A330s number two and number three will also have General Electric propulsion systems, and will make their first flights in November 1992 and May 1993 respectively. The first of two A330s powered by Pratt & Whitney PW4164/4168 engines should take off for the first time in October 1993. According to Airbus plans A330 number five (with PW engines) will follow 3 months later in January 1994. In the interim the first A330s (serial number 012) will be retrofitted from GE to Rolls-Royce-Trent engines, so that they also may rejoin the test fleet in January 1992. As the last plane in the flight test program, finally another A330 equipped with a Rolls-Royce-Trent engine is planned. Its first take-off should take place in August 1994.

Airbus Industrie expects certification of the CF6-80-equipped A330 by the European certification authorities to come in October 1993. The U.S. FAA authority is supposed to give its blessing a month later. Certification of the model equipped with the PW4000 is anticipated for April 1994 (by the JAA) and May 1994 (by the FAA) respectively. By the end of 1994 the certification documents for the A330 with the Rolls-Royce propulsion system should be presented to Airbus. Deliveries to airlines should follow in each case a short time after certification.

Airbus expects that the 180-minute ETOPS certification for the CF6-equipped plane may be given as soon as 6 months after the first delivery. For the other two A330 propulsion systems the 180-minute permits should be available as soon as the planes are put into service, so that properly qualified airlines will be able to fly the A330 over ETOPS routes from the very start. This will be a first in the history of commercial air travel.

Final Assembly of Airbus A321 Begins in June

When the International Aeronautics Exhibition '92 opens its gates on June 15 probably only a few officials of Deutsche Airbus (DA) will be present in Berlin. For on the same day the official start of the final assembly of Airbus A321 is to be celebrated in Hamburg-Finkenwerder. On June 15 the fitted-out wings of the A321 prototype will be flown by the British Aerospace Airbus Division in Filton, Great Britain, to Hamburg, and brought into the Otto Lilienthal Hangar, where during the month of July they will be joined to the fuselage. In order to join the wings to the fuselage 2,000 riveted joints are necessary.

Five days before this, on June 10, the cockpit and nose section of the fuselage will arrive from Aerospatiale. The tail section and central section of the fuselage are already in Hamburg—they are manufactured by DA and since April have been in fitting-out assembly. DA at present is fitting them with the equipment necessary for the flight test, such as, ballast tanks on the main deck, through which various centers of gravity can be simulated.

Between the delivery of the first fuselage section and the delivery of the aircraft to the airline 46 days elapse, out of which each new aircraft spends 28 in final assembly in the Otto Lilienthal Hangar, spending 4 days at each of the seven work stations in the hangar. The remaining time is required for interior fitting-out, flight testing, and delivery to the airline. As of now Airbus has in hand 140 firm orders from 10 customers for the extended version of the A320. In addition to the leasing companies GPA and ILFC—Alitalia, Swissair, Austrian Airlines, Deutsche Lufthansa, Ansett Australia, Air Inter, Euralair, and Iberia have all ordered the new model.

During this year the assembly of three A321s will begin in Finkenwerder. According to present plans eight A321s will go through final assembly in 1993. In 1994 the number will increase to 24 aircraft, and in 1995 will almost double, increasing to 45 units. The capacity of the final assembly line does not end here however. If necessary the production rate can be raised to five aircraft per month.

The A321 is taking shape. The rear and middle fuselage sections are joined.

Sextant Builds Head-Up Display for Airbus A330/340

92WS0610B Stuttgart FLUG REVUE in German
Jun 92 p 73

[Article by Heinrich Hemker]

[Text] After good experiences with head-up displays in the Airbus A320 a system of this type will also be developed for the Airbus A330/340. With the display of camera- or sensor-generated images the capability range of such instruments is clearly widened.

In the cockpit of a civilian aircraft a head-up display is the exception. However the display of indications on the screen has definite advantages even for civilian aircraft, especially during take-off and landing. The first attempts to demonstrate this were made two decades ago. The philosophy of cockpit development at that time, however, was directed towards landing automation—it was no longer necessary to provide the pilot with data when he looked out of the cockpit.

A change in trend is now becoming apparent. The HUD is becoming increasingly important. Since the Display and Interfaces Division of Sextant Avionique in Saint-Medard-en-Jalles has had positive experiences with the equipment of the Airbus A320 of the French airline Air Inter, a HUD for the A330/340 will now also be offered.

The system consists of the projection unit and the HUD computer. The projection unit is located above the head of the pilot. The HUD computer forms the connection between the display management computer and the HUD projector. The integrated character generator triggers the projection system, where a miniature cathode ray tube (CRT) generates a symbolic image, which is projected onto the screen. The lens coverage has an angle of view of 30x20°.

An aircraft equipped in this way is in a position to land and take off even in airports whose visibility minimums actually prohibit their use on account of a lack of landing aids. Christian Michaudet, air transport marketing manager of Sextant, explains the two possibilities for improved performance: Either a landing with a Category I/II aircraft can be made according to Category IIIa on an unequipped landing strip, or landings according to Category IIIb are possible with a hybrid system, which consists of an autopilot for Category IIIa and a HUD. The latter possibility is of particular interest, since fitting-out with an efficient autopilot is substantially more expensive.

Another aspect of the utilization of HUD technology has recently come to the fore—the possibility of the display of images on the screen as well as symbols. In the vision-supported systems which are presently under development (Enhanced Vision System, EVS) the data which are obtained through radar, microwave, or infrared sensors are processed into an image signal. With such a system it would be possible, for example, to show in the HUD a landing strip which the pilot cannot see with his naked eye, but whose contours will be recorded by microwave sensors. Sextant has commissioned the American firm Maryland Advanced Development Laboratory (MADL) to outfit a Cessna 402 with a HUD, in order to demonstrate the EVS capability of the HUD to pilots. The required sensors will be furnished by Thomson-CSF.

The U.S. firms Collins Avionics, Kaiser Aerospace, and the Eastman Kodak Company have also signed contracts for the development of an EVS system. Through the display on the screen of pictures from an infrared

camera, approach flights to Category I landing strips should become possible under Category IIIa visibility conditions.

With the development of EVS systems HUD manufacturers are attracting more and more interest. The purchase of the HUD manufacturer Flight Dynamics of Portland, Oregon, which had also developed a system for the Dornier 328, by the electronics giant Hughes, demonstrates this clearly.

Alternative Proposals for Hermes Considered

92WS0612B Stuttgart FLUG REVUE in German
Jun 92 p 56

[Article by Goetz Wange]

[Text] Hermes is not financeable as a service vehicle for the free-flying Columbus space lab. In place of this the ESA in cooperation with NASA intends a rescue capsule for astronauts.

Nothing has been decided as yet. However in the face of financing problems the European space organization, ESA, is preparing itself for a marked reduction of its long-term program. By summer a proposal will have to be worked out for the meeting of the Council of Ministers, which is scheduled to take place in November in Spain. There is also the question to be answered as to whether the burdens can be more widely distributed by taking on new partners. At the present time the inclusion of Russian technologies into the Hermes program is under especially close scrutiny.

At the end of March the ESA decided to spend about DM10 million within the next 6 months for a more intensive examination of the possibilities. Payment will be made by the space organization directly to the Russian institutes and firms which have been approached. In addition to space suits for outboard maneuvers and ejector seats for the Hermes crew, flight path calculations, aerodynamic questions, batteries of advanced design, and above all materials for thermal insulation systems are among the selected areas of interest. Consideration is also being given to the use of simulation facilities on the ground and the training of astronauts.

Independently of this the ESA is presently considering how ambitiously the Hermes program can be continued. "At the present time we are looking into several scenarios," Jorg Feustel-Buechl, ESA director for space transport systems, explained in an interview with FLUG REVUE. Conversations with the American space authority NASA are turning out to be particularly promising. NASA is also having budget problems, but at the same time must develop a rescue capsule for the space station. "In our conversations we have determined that there are no insurmountable obstacles to cooperation in this area," ESA manager Feustel-Buechl emphasized. In a second round of talks, which will run until the end of June, more concrete plans are to be discussed. According to the ideas of the ESA the rescue capsule could be built

completely in Europe. In contrast to Hermes, the vehicle would not be winged, but would be more like a modern version of the Apollo capsule. Nonetheless in some areas technologies are to be used whose development has already been started in Europe and which have been designed for Hermes. The heat shield, for example, is to be designed in such a way that the rescue capsule will be reusable. The propulsion section could also be further developed from the Hermes program.

Criticism is already coming from the Hermes team in Toulouse. "Such a capsule, with a life support system and other costly technologies, will be at the most 20 percent cheaper than the European orbital glider," they are saying.

A further interesting cooperative venture between the ESA and NASA is going on in the area of rendezvous and docking. By 1995 a joint mission could be made in which a technology platform will berth at a target vehicle.

Saab Group Reorganizes, Cuts Workforce

92WS0624B Duesseldorf HANDELSBLATT in German
16 Jun 92 p 22

[Unattributed article: "500 Jobs Cut by 1994: Into the Future With the SAAB 2000 Regional Aircraft"]

[Text] Berlin, 15 Jun (HANDELSBLATT)—In the wake of a rationalization program of the Saab group, Saab Aircraft AB of Linkoping, Sweden will cut 500 of 2,000 jobs by 1994. At ILA '92 [International Air and Space Show] the civil aviation subsidiary of the Swedish group attributed the drastic personnel reduction on "the difficult market for civil aircraft."

The aviation activities of the group have been divided since April into the three areas Saab Military Aircraft, Saab Aircraft AB, and Saab Service Partner AB. In 1991, with approximately 6,900 employees, the entire aviation area achieved sales of \$850 million, 70 percent of this in the civil sector. In 1991, the Saab Group had sales of more than \$5 billion.

Saab Aircraft describes itself as the worldwide market leader for regional aircraft. The most successful product is a 30- to 40-seat plane, the Saab 340, of which 59 were delivered in 1991 alone. Orders are reportedly in hand for an additional 38. Worldwide, the plane's market share is reportedly 37 percent; in Europe, 60 percent. In the U.S., the largest market, 180 of the aircraft are already in service. A total of 366 planes have been delivered since 1984. Production is currently 50 planes per year. However, capacity for 100 planes per year exists.

At the ILA the Swedes introduced a 50-seat regional aircraft in the prototype of the Saab 2000, which will be among the fastest and quietest planes in its class. Approximately 200 orders or options for this jetprop are already in hand.

Saab Military Aircraft has begun series production of the JAS 39 Gripen fighter. The first plane is to be delivered to the Swedish air force in 1993.

Activities of DASA, Smaller German Companies Viewed

92WS0624C Duesseldorf *HANDELSBLATT* in German 16 Jun 92 p 24

[Article by J. Reuss: "Small- and Medium-Sized Industry Sees Better Export Opportunities for its Niche Products: Concern About the Jaeger 90 Overshadows Many Recent Successes in the Industry"]

[Text] The activities of the German aviation industry are currently marked essentially by the tightening of the structures of the Daimler-Benz Group's Deutsche Aerospace AG (DASA). "We will be beset with uncertainty and change—but also with confidence, clearer structures, and the increasingly viable vision of an international company," said Juergen E. Schrempp, DASA chairman of the board, recently at the press conference to announce business results. The small- and medium-sized industry is also hoping for an expanding market with some aircraft and products which are ready for series production.

The prospects for success of aircraft "made in Germany" have seldom been good. After World War II, the German aviation industry had to live with extremely unfavorable starting conditions compared to the European and American competition. Now the problem is the enormous development and production costs for an aircraft with modern technology capable of asserting itself in the fiercely contested international market. The degree of sensitivity with which the aircraft market can react was demonstrated by the effects of the Gulf War. Before the conflict in the Gulf, it was necessary for airlines to figure in a 5-year delivery period for a new commercial aircraft; now order cancellations are the order of the day so that an orderer can have a new aircraft at his disposal even within a very short time. Long-term projections forecasting continuous growth in the number of passengers and prospects for new markets such as in Eastern Europe only partially calm the management in the aircraft industry. The disappearance of military orders and the fading prospects for the success of the Jaeger 90 will force additional structural changes particularly for German aircraft builders.

Since the restructuring of the German aviation industry, which was tackled 2 years ago, the company names Deutsche Airbus GmbH and Deutsche Aerospace AG have emerged. Deutsche Airbus GmbH is one of four partners of the European umbrella company Airbus Industrie. It participates in the company under French law, which is responsible for marketing and sales of Airbus planes, at the rate of 37.9 percent. Large parts of the fuselage, the rudder assembly, and the interior equipment for all Airbus planes—with the exception of the new models A330 and A340—come from Germany. The

latter two types of planes are outfitted in Toulouse. France is responsible for the cockpit, some fuselage sections, and final assembly, except for the A321.

In the case of the A321, a stretch version, 7 meters longer of the A320, the Airbus Consortium opted for an integrated final assembly line in Hamburg. For this plane, final assembly and outfitting takes place at one site under the responsibility of Deutsche Airbus GmbH. Simultaneously with the beginning of the International Air and Space Show (ILA) in Berlin on 15 June 1992, final assembly begins in Hamburg-Finkenwerder. The assembly and delivery of the first Airbus plane at Deutsche Airbus GmbH opens a new chapter in European aircraft construction. Hartmund Mehdorn, managing director of Deutsche Airbus GmbH, sees in it an "expression of obvious, increasingly extensive cooperation of the partners" and—in conjunction with the latest decision for final assembly at Hamburg for the A319, a shortened version of the A320, as well—for the traditional-rich aircraft construction city of Hamburg, future-oriented development into the center of construction of narrow-bodied Airbus aircraft.

The twin-engine A321 is, like the A320, equipped with advanced, highly modern "fly by wire" technology. In the typical three-class configuration, it flies approximately 4,350 km with 186 passengers and is thus suitable for short and medium hauls with higher passenger revenues.

Suppliers From Europe Despite Final Assembly in Hamburg

Although final assembly takes place in Germany, suppliers are international. Deutsche Airbus is responsible for most of the fuselage. The sections are equipped and tested complete with all systems or subsystems (air conditioning, freight loading, electrical, flight control, fuel, water, hydraulic, and emergency evacuation systems). Add to these the landing flaps, the rudder assembly of CFS (carbon-fiber-reinforced synthetic) and the complete outfitting of the interior. The French company Aerospatiale is delivering the cockpit and the front of the fuselage, wing center frames, and engine mounts. British Aerospace produces the wings and a central fuselage segment as well as the ailerons. Casa in Spain provides the elevators and the skin for the rear section of the fuselage. The associated Airbus partner Belairbus of Belgium produces the slats. Additional small parts also come from Alenia in Italy and Kawasaki in Japan. The final assembly line in the newly built 314-meter-long "Otto Lilienthal Hall" with room for 11 A321's is installed at the plant airfield in Hamburg-Finkenwerder. The takeoff and landing strip has been extended by 400 m to 2,328 m.

Currently, there are 144 orders for the A321. Final assembly will begin this year. In 1993, eight A321's will be built, followed by 24 in 1994, and, finally, 45 in 1995.

By 1996, production should be up to capacity. Approximately 550 employees will then produce five aircraft per month.

Five A321s per Month by the Mid-1990s

The traditional aviation company Dornier is under the umbrella of the Daimler-Benz subsidiary DASA. The company has produced approximately 200 aircraft of the type Dornier 228 in recent years. Because of its robustness and efficiency the commuter and utility plane has proven itself even in applications under extreme conditions. Dornier aircraft engineers have emphasized comfort and modern technology in Dornier's new development, the 328. This model is a 30- to 33-seat high-tech airliner, new from the ground up, for regional commercial aviation. With an exceptionally high cruising speed for a turboprop of 600 km/hr, jet-like comfort for the passengers, and a roomy soundproof cabin as well as the environmentally sound PW119A engines, the aircraft sets a new standard. As the most modern commercial aircraft, the regional plane is equipped with an efficient screen cockpit. Flight tests with two preseries planes are currently coming to an end. After type approval from the aviation authorities, the aircraft should go into airline service in mid-1993.

For Dornier salespersons it is particularly encouraging that this aircraft has gained a foothold so quickly in the highly competitive North American market. The US carrier Horizon Air of Seattle has issued a large contract with 35 firm orders and 28 options. An even larger order from the USA fell through due to financial problems of the orderer. At the end of the 1991 fiscal year, there were a total of 45 orders and 29 options for the 328. The Dornier 328 designers are already working on a 48-seat version with the model number Dornier 328S.

At Deutsche Aerospace, which serves as an umbrella company for the well-known companies Dornier, Messerschmitt-Boelkow-Blohm, and MTU Motoren-und Turbinen-Union, as well as Telefunken Systemtechnik, discussions have been under way for a long time concerning an 80- to 130-seat regional commercial aircraft, the final remnant of the failed attempt to build the MPC75 jointly with China. Because of the growth of regional markets, the shortage of slots at the major large airports, and the demand for more direct connections as well as different passenger behavior between 1996 and 2009, market observers envision demand for approximately 2,000 planes. DASA believes the partnership and cooperation with Aerospatiale (France) and Alenia (Italy) should be expanded through the inclusion of Fokker (the Netherlands).

Cooperation is also the trump card in MBB's helicopter activities. Under the company name Eurocopter, the product lines of Aerospatiale and MBB have been harmonized since last year. The tried and tested BO105 is capable of holding its own in the highly competitive market. An improved successor BO108 is currently being tested. Modifications based on client needs still have to be taken into account. The BK117 helicopter

produced jointly with Kawasaki Heavy (Japan) is finding buyers primarily in the North American market. One of its major applications is in air rescue service. The foundation of Eurocopter also means that the final assembly of the French AS350 Ecureuil is now taking place at the Donauwoerth plant.

There is new impetus in general aviation aircraft. Because production of the well-known manufacturers Piper and Cessna in the USA has virtually come to a standstill, the European and German aviation industry feels that it has quite good opportunities in this area. It is based on high-tech aircraft of composite materials. As a completely new development, as far back as the 1988 ILA in Hannover, the southern German company Grob announced a four-seat passenger plane driven by a pusher engine (propeller in the rear), and can thus reach a cruising speed of 425 km/hr. Now the Grob GF200, as the model is called, is already in advanced flight tests. The Porsche aircraft engine (PFM) had been planned as the engine, but the departure of Porsche from aircraft engine construction forced a revision. Now the GF200 is powered by a Textron Lycoming TIO-540 with 201-kW output (273 DIN-PS). The aircraft built with a subsidy from the Bonn Ministry for Research and Technology (BMFT) has a range of approximately 1,950 km and could become the basis of an entire family of aircraft. This could include a six-seater and a variant with a turboprop engine. Grob can call upon years of experience in glider construction and in development and production of small single-engine planes, such as the Grob G115 trainer and passenger plane. However, an interesting special order—development and construction of a plane for high altitude flights for reconnaissance and environmental monitoring ("Egrett")—currently seems to be in jeopardy.

FFT, Gesellschaft fuer Flugzeug- und Fasertechnologie mbH, of Mengen, has also taken up the banner of modern, efficient aircraft for general aviation. Although it does not intend to exhibit its aircraft program at ILA '92 in Berlin, it can point to interesting products. These include the canard plane, Speed Canard SC01, and the Eurotrainer 2000A as well as a four-seater stunt and training plane with retractable landing gear.

The Ruschmeyer Luftfahrttechnik GmbH of Melle bei Osnabrueck is among the newcomers. Just in time for the ILA '92, the Federal Aviation Office in Braunschweig granted the Ruschmeyer plane R90-230RG type approval after 6 years of development under a subsidy from the state of Lower Saxony. This clears the way for production. A new material specifically for aviation applications was approved for the four-seater.

Opportunities for Interesting Export Orders From Throughout the World

With improved aerodynamics, the glass fiber-synthetic construction system (BASF's Palatal A340 resin system), which forms even the primary structure, permitted good

flight performance and production processes which could not have been justified economically in conventional metal construction. Thus it was possible to reduce the number of structural assemblies by 70 percent compared to metal construction. According to information from Ruschmeyer, in contrast to comparable passenger planes on the market today, a fuel reduction and thus a pollutant reduction of 20 to 25 percent has been achieved.

The aircraft builder from Melle also had to rework its design after the Porsche decision. Instead of the Porsche PFM 3200 engine, a Lycoming IO-540-C4D5 engine has now been incorporated. It is also noteworthy that it was possible to go 8.1 to 10.2 dB(A) below the strict noise abatement requirements which must be met for approval of an aircraft. At a maximum cruising speed of 324 km/hr, it can cover a distance of 1,618 km. The airframe is approved for a service life of 18,000 flight hours. Furthermore, during structural tests the equivalent of 54,000 hours was simulated without material fatigue being detected.

The Ruschmeyer R 90-230 RG will be offered through a worldwide sales network. According to Horst Ruschmeyer: "We are working on the assumption of an export rate of 90 percent. We currently have 21 orders."

Many ILA visitors will search in vain this year for an amphibious plane. The Dornier Composite Seastar aquaplane, which always caused a lot of fuss at past air shows because of its technical perfection in construction and efficiency, is no longer being built. After some financial turbulence, Dornier's successor company had to declare bankruptcy.

Airbus A340 Demonstrated at Berlin Air Show

92WS0624D Duesseldorf *HANDELSBLATT* in German
15 Jun 92 p 15

[Unattributed article: "Demonstration of the A340 at the ILA '92 in Berlin: 600-Seater Will Not Be Out Before 1995"]

[Text] Berlin, 13/14 Jun (*HANDELSBLATT*)—Airbus was able to manage a demonstration of its four-engine A340, on the eve of the opening of the ILA '92 (International Air and Space Show) in Berlin. This long-range aircraft of the new generation has already completed half its scheduled flight testing in Toulouse. A total of four A340's are already flying, including three of the A340-300 type, with which 295 passengers can travel as far as 13,200 km, and one A340-200, which can carry 262 passengers nonstop for 14,400 km, and thus has a longer range than any other commercial plane in the history of aviation.

According to Heribert Flosdorff, the German representative in the top management of Airbus Industrie in Toulouse, the maiden flight of the twin-engine A330 is

scheduled for the third quarter of 1992. In its standard configuration, this plane can carry 335 passengers a distance of 9,800 km.

The family of the small Airbus is also being completed. In addition to the 130-seat standard A320 version which has already been delivered for a long time, final assembly of the stretched version, the 186-seat A321 will begin at the end of this month in Hamburg. In May Airbus began to present the shortened version, the A319 with 124 seats, to potential first customers. It was possible to hold the development costs for the shortened version of the A320 down to a very low \$275 million.

In the 20 years of its existence, as of mid-May 1992, Airbus Industrie had delivered 891 aircraft to 87 buyers worldwide. These planes were of the types A300, A310, and A320. This record number of deliveries caused 1990 sales of \$4.6 billion to rise to \$7.4 billion last year. The European Airbus Consortium composed of the four partners Aerospatiale, Deutsche Airbus, British Aerospace, and Casa expects sales for the entire year of 1992 to be as high as last year. Through flexible adaptation of production, Airbus Industrie weathered the worldwide recession in international aviation, which led primarily to order cancellations and delays in calls for planes already ordered in the wake of the Gulf War. However, Airbus management believes that by the year 2010 the market researchers' forecast of over 12,000 large commercial planes will be reached despite the current market weakness. This will include more than 7,000 replacements for old aircraft; the remainder will cover new demand. A sustained recovery in passenger numbers is anticipated as early as the end of the year. An annual increase in passenger numbers of almost 5 percent should be anticipated for 1992, at least according to Airbus managers. As the second largest international builder of large commercial aircraft Airbus Industrie is counting on a 30- to 35-percent share of this market.

The beginning of a program for a super jumbo with more than 600 seats must not be expected before 1995. Airbus is still evaluating market research from the period since 1990 in this area.

British Aerospace Gets Boost With Harrier Jet Contract

92WS0789G London *THE DAILY TELEGRAPH*
in English 3 Aug 92 p 2

[Article by David Black, transport correspondent: "BAe Defence Jobs Saved by £300m Harrier Order"]

[Text] British Aerospace has won a £300 million contract to build a new type of two-seat Harrier "jump jet" for the Royal Air Force.

The order for 13 aircraft, designated the T-10, is based on a design for the US Marine Corps, the TAV-8B.

The new Harrier will have night vision equipment so that it can be used as a front-line combat aircraft, as well as in its primary role as a trainer.

A Ministry of Defence spokesman said: "The T-10 will provide Harrier pilots with a comprehensive training programme covering vertical take-off, short landing operations and day and night attack missions."

Mr Jonathan Aitken, Minister for Defence Procurement, said: "The T-10 will greatly enhance the quality of training for our Harrier force, while its versatility will allow it to provide a useful addition to the front line if required."

"I am delighted that we have been able to secure a satisfactory contract for these aircraft with one of our major defence suppliers."

The aircraft are expected to enter service in 1994, and the order will do much to help to secure 30,000 aerospace defence jobs.

The order marks a further boost for BAe's military aircraft division, which last April received confirmation from Saudi Arabia that its £1.5 billion order for 48 Tornado fighter-bombers and 60 Hawk trainer-fighter aircraft would go ahead.

This was in addition to the vast £10 billion Al Yamamah, oil-for-weapons programme which includes an original 72 Tornados, 30 Hawks, three minesweepers and an extensive spares and maintenance deal with BAe, involving work for 3,000 BAe staff in Saudi Arabia.

BAe is already going through a severe retrenchment programme which has seen the company cut 40,000 jobs since 1987 and struggling to cut its cloth to meet a gap in production between the ending of the Tornado line and the hoped-for start of the European Fighter Aircraft.

Most in danger have been the three Lancashire military aircraft plants, at Warton, Preston and Samlesbury, already in the midst of a big restructuring programme which will mean the loss of more than 3,000 jobs and the closure later this year of Preston.

AUTOMOTIVE INDUSTRY

France To Provide Terminals for Electric Cars

92WS0534A Paris AFP SCIENCES in French
16 Apr 92 pp 37, 38

[Article: "Electric Car Is (Almost) Just Around the Corner in France"]

[Text] Paris—Within less than 2 years, Tours and La Rochelle will be equipped with terminals in the very center of the cities, and on an experimental basis, enabling drivers of electric cars furnished by the PSA Peugeot-Citroen group to recharge their car batteries.

The electric car would thus seem to be just around the corner. A recent study, however, published by AUTO-FACTS (United States), indicates that, with 96,000 registrations (including 28,000 in Europe) by 1998, it is not expected to represent more 0.2 percent of the world market by then, and that not until around the year 2010 can annual sales be expected to attain two million cars (of which 742,000 in Europe), or 5 percent of the market.

The French prototypes currently circulating have all been developed starting from commercially-produced assembly-line models, so as to reduce development costs. Thus, there are the Peugeot 205 and 106, the Citroen AX, and the Renault Clio, all of which, for the moment, offer approximately identical performance characteristics. Take the Peugeot 205, for example. Crammed full of batteries in front, and equipped at the rear with a retractable cable resembling the power cord of a vacuum cleaner, it recharges in 6 hours from any terminal delivering current at an intensity of 16 amperes.

When fully charged, a meter located at the center of the dashboard indicates 200 ampere hours [amp-hrs]. Theoretically, the engine consumes 2 amp-hrs per kilometer, and therefore has a range of 100 km, which is altogether sufficient for daily urban use. But it is not quite sufficient for daily suburban-urban use. For, while the Peugeot 205 indeed consumes 2 amp-hr per km, provided it is already up to speed, covering 15 or 16 kilometers in congested traffic, with 50 amp-hrs of charge, becomes quite an achievement.

Furthermore, the last 30 amp-hrs indicated by the meter are virtually useless, so that the car's usable charge is no more than 170 amp-hrs, providing a range of only 50 to 60 km, which is insufficient for suburban use.

Today's electric car—which is driven with two pedals, one the brake, the other the accelerator, no shifting of gears, and the mere depressing of a button to change from forward to reverse and vice versa—is therefore an urban vehicle par excellence. It is very quiet, nonpolluting, and has good acceleration, enabling it to pass discreetly in traffic, with a peak speed of 80 km/hr. But it presently poses a difficult problem, namely, the need for daily recharging, especially since even car-park owners generally do not have charging-current terminals.

To these objections, Peugeot-Citroen and Renault respond that future electric cars, which will truly be built "around" their motors, can be expected, within 3 or 4 years, to have a real range—all traffic conditions considered—of a little over 100 kilometers. As for the problem of installation of charging-current terminals in urban centers, the manufacturers emphasize that it is one that the governmental authorities must resolve if they wish to see the use of electric cars by the citizenry start, tomorrow, to become a reality.

There remains the problem of the cost of these cars. True, a "full charge" of current—that is, enough to cover some 100 kilometers—should hardly cost more than 7 or 8 francs [Fr]. But while the manufacturers say that

within 3 or 4 years they will be ready to market an electric car for the price of an ordinary car, they immediately stipulate that this is "without battery." And the battery will in all probability cost between Fr10,000 and Fr15,000 depending on whether it is of the lead or nickel-cadmium type.

Here again, according to the manufacturers, everything depends on the governmental authorities and the subsidies they will be willing to contribute to significantly reduce the price of these cars.

EUREKA's MOSAIC Project Uses Composites to Lighten Cars

92WS0738A Paris L'USINE NOUVELLE in French
9 Jul 92 pp 44, 45

[Article by Jean-Michel Meyer: "How Automobiles Are Shedding Kilos"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Making cars lighter means reducing fuel consumption, and thus pollution. Composites are gaining ground, but steel may yet make a comeback. To be continued...

The way plastics and composites have crept into auto-body components, cases, tanks, and even mechanical parts might suggest that vehicles have gotten lighter over the years. Nothing could be further from the truth. Overly preoccupied with ride comfort and safety, manufacturers have somewhat neglected to keep track of their vehicles' weight. Spokespeople at Renault, for instance, point out that "the Safrane weighs 10 percent more than the R25." The Espace, with its body of composite materials, has never got off the drawing board.

Consequently, manufacturers and equipment suppliers are trying to reverse the trend. "Today, making our cars lighter is our top objective," confides Georges Douin, Renault's technical director. The reason: the need to reduce fuel consumption and lower pollution levels.

To help its cars shed those superfluous kilos, the French automaker has been collaborating with six European companies since 1991 in a Eureka project dubbed Mosaic (optimized materials for an innovative automobile design). "We are looking for a no-cost way to lighten vehicles, without raising their price," says Henri Mathiolon, the program's coordinator. Mosaic has a budget of 360 million French francs [Fr] and involves, besides Renault, Switzerland's Ciba-Geigy (adhesives), Holland's DSM (composites), two Italian companies—Enichem Polimeri (resins) and Montecatini (reinforced polymers), of the Ferruzzi-Montedison group—Norway's Hydro Aluminium Automotive (light alloys), and France's Sollac (steel).

Their research is expected to result in the construction of two prototypes by late 1993. But Renault will not decide whether to take the plunge until it has checked the performance of the new materials against its specifications sheet.

Today, the two half-completed projects illustrate the war between composites and steel. Threatened on its own turf, steel may well make a comeback. Ford, for instance, is studying the possibility of incorporating large amounts of high-strength steel into the autobodies of its next generation of minivans—except for the hoods, which will be made of composites. This option will raise costs by at least five percent on each vehicle. "The materials battle is fierce," observes Henri Mathiolon. "Steel is an adult, in full possession of its faculties and showing potential in new areas. But other materials—aluminum and plastics—are maturing and putting the pressure on."

Two Designs: All-Steel or Hybrid

For now, the baseline Mosaic project is still an all-steel design for the entire structure (painted body without sun roof) that was developed by Sollac. Ciba-Geigy will do the assembly and welding work. The design calls for two materials: high-elastic-limit (HLE) steels that reduce sheet-metal thicknesses 0.7 to 0.5 millimeters to 0.35 millimeters; and sheet-metal sandwiches used for the body's underside. The sandwiches are made of a 50-micron polymer film tucked between two metal "skins", with the whole sandwich measuring no more than 8/10th of a millimeter. They are stamped and welded together like any other steel part. Finally, the sandwiches make it possible to dispense with sound insulation. The lightened sheets reduce weight by an average of 25 percent and welding spots by 30 percent.

The second, hybrid, design combines aluminum and composites. Depending on the parts used, it can reduce weight by 30 to 40 percent. The design consists of a front piece, a "bird cage" (body) of three-dimensional, roll-bent, extruded aluminum sections, and modular partial assemblies of composite materials. Hydro Aluminium is in charge of the aluminum parts and DSM of the composites. The Dutch chemicalmaker has also studied a front piece of glass-fiber-reinforced thermoplastic resin, which improves stiffness 40 percent over classic composites. "And it can absorb two to three times the energy generated by high-speed impacts that metal materials can," asserts Win Adriaens, the composites general director of DSM Resines. The Italians are responsible for the floor—from the pedals to the very rear of the vehicle, or a surface of four square meters—and Mosaic participants expect it to be a single piece. Montecatini is developing a glass-fiber-reinforced duroplastic polymer floor. Enichem Polimeri is working on the same section, but using a high-elastic-modulus composite with a polyurethane base as a starting point. The technology employed involves impregnating a glass-fiber preform by injecting the two polyurethane components (polyol and isocyanate) during the liquid phase. A flat floor can be fabricated in one step with the process.

But manufacturers are also looking at ways to lighten mechanical parts. One example is drive shafts, which are being studied in the Cars and Light Vehicles Division of the British group GKN. Significant gains in weight

reduction have been made. While traditional steel longitudinal shafts (for four-wheel-drive vehicles) weigh 10 kilos, shafts with a composite connecting piece weigh only five. The latest generation—all-composite, of carbon-reinforced epoxy resin—weighs 2.5 kilos. Besides reducing weight, the elimination of a gasket and a bearing simplifies design and assembly and improves comfort—by decreasing noise and vibrations—and safety. The composite shaft can be designed to give way under the shock of an impact, or to transmit the energy absorbed to the rear of the vehicle.

GKN's composite longitudinal drive shafts equip the Espace Quadra, the Audi 90 Quattro, and the Safrane Quadra. Over the next few months, they are expected to be used in three new applications in Europe and Japan.

Other examples of mechanical parts now being made of composites are end caps, joints, and lateral transmissions. GKN is offering a transmission joint socket composed of an outer envelope of epoxy resin reinforced with pull-wound long glass fibers, a cap, and six threads of treated steel. The whole thing is assembled in a duroplastic matrix reinforced with short glass fibers. The result is a gain of 300 grams in a part that weighs one to 1.5 kilos.

Reducing the weight of vehicles has become an imperative. The purpose is to decrease fuel consumption—the new, absolute priority for automakers.

Renault, PSA Discussing Collaboration

92WS0738B Paris L'USINE NOUVELLE in French
9 Jul 92 pp 18, 19

[Article by Alain-Gabriel Verdevoye: "After Every Man for Himself, Renault and PSA Try a Pas de Deux"; first paragraph is L'USINE NOUVELLE introduction]

[Text] For the second time in the space of a few weeks, the CEOs of the two French automobile groups are going to consult. On the agenda are bilateral collaboration and a squaring of their positions on the big issues.

Are the two fraternal enemies of France's auto industry about to trade in snide remarks for honeymoon coos? Not yet. But the presidents of Peugeot (PSA) and Renault are seeing each other. And that is already a big step forward, much welcomed by the Ministry of Industry. After a first interview last 22 June, Jacques Calvet and Louis Schweitzer, who succeeded Raymond Levy as the head of Renault in late May, are scheduled to meet again before the end of the month. Moreover, a program of monthly meetings has been set up through next December.

The interviews' agenda will include bilateral collaboration and a squaring of respective positions on the big issues in Brussels. PSA has described the first contact between the two CEOs, who share training and experience as cabinet ministers, as "very positive." True, the meetings are only preliminary. But—necessity being the

mother of invention—once trust has been established, they could rekindle industrial cooperation or research and spur significant collaboration on subsidies for industrial restructuring or the environment.

For, despite their disagreements, the two automakers have similar objective interests and are faced with the same intractable production costs. Both PSA and Renault are relatively isolated in Europe—Renault's alliance with the "small" Swedish company Volvo notwithstanding—and urgently need to achieve some economies of scale. Moreover, they make bottom- and middle-of-the-line vehicles in aging plants, with workers whose profile is identical: older and not very educated. They share 80 percent of their subcontractors, and each holds about the same percentage of the French market (around 30). This would seem to make a convergence logical.

Industrial collaboration is the first focus of possible closer cooperation between Renault and PSA, and its consequences would be the most tangible. Such an idea is not virgin territory for the two automakers. For the top-dog war between Jacques Calvet and Raymond Levy did not end two decades of joint projects.

New Shared Engines

The automakers signed an agreement in late 1990 on a new six-cylinder engine that is slated to come out around mid-decade. PSA will do the research for it, while Renault will define the production methods. A second agreement on a joint automatic transmission was officially concluded in May. The transmission project will be headed by Renault this time, assisted by 20 PSA technicians.

"If Renault proposes new joint projects with PSA, its shareholders will not hesitate for a second," stresses the Ministry of Industry. On the contrary. The two groups may eventually research and build new engines and transmissions together. "It would make sense for the two to collaborate on the design of suspension—and even complete transmission—systems," says an expert. Volvo is too small and too specialized at the top of the line to meet all of Renault's needs for components. Renault and PSA may even jointly develop a niche vehicle, provided that the outside and inside style differ. Closer collaboration between the two may lead to a sharing of certain manufacturing sites or the use of each other's plants.

If the two firms can work together on components, they can also collaborate efficiently with respect to their equipment suppliers. Renault and PSA have everything to gain by working together to standardize their supplies. The aim would be to avoid investing time and money duplicating the design and industrialization of components that are often similar.

The stakes involved in the recycling of wrecks are also enormous. A profitable system for handling auto scrap that meets future European standards must be organized. Efforts here are well advanced, since Renault and PSA will announce an agreement Thursday, 16 July to reciprocally open recycling centers that will work for both groups. It is said to be one of the highlights of bilateral cooperation between them.

Research is a second focus of collaboration. The two car makers have already teamed up on several European and Franco-French programs. The Eureka Agata project on gas turbines has just resumed, following a pullout by the German manufacturers. Joint research into a compact, light, and economical compression-stroke engine at Renault in Rueil should reach the industrialization stage in 5 years. And an agreement on a shared simulator to assist in vehicle design has just been signed. In the future, new team efforts between the two automakers should focus on pollution reduction, vehicle safety in the Vehicles and Road Safety Program that is now being set up, and assisted-driving and -navigation systems.

Between joint industrial endeavors and research programs, Renault and PSA have plenty of ways they can put their willingness to work together into practice. But it is in the political realm that PSA would like to see more immediate results. "Renault and PSA have close positions on the big issues. And in the din of Community lobbying, they would do well to express their viewpoints as one," stresses the Ministry of Industry. Renault and PSA would gain from jointly voicing their needs for industrial restructuring and educational subsidies in both Community and French forums.

PSA would also like to bring Renault around to its views on antipollution standards. The private group, whose cars consume less total fuel than German ones, would like energy considerations to be taken into account in future Community standards. And Renault stands only to gain from a system that adds fuel into the equation. Government authorities, for their part, would be happy to see a convergence of the two manufacturers' viewpoints, which would shore up the Latins (including Fiat) against German firms in negotiations with Brussels.

Such a meeting of minds, however, is no mean trick for Jacques Calvet and Louis Schweitzer. The former is not one to give up his provocative candor or his deeply-held conviction that he is always right. The latter is constrained by his relations with the other European automakers in the European Automakers Association (ACEA), and his ties with the state shareholder, which has no choice but to be cautious. The two have begun a *pas de deux*. Now they just have to agree on the music.

Boxed Material: The Principal Joint Programs of Renault and PSA in France

The following is a list of the research topics and studies that are being pursued jointly by Renault and PSA. The industrial projects include:

- the V6 engine. The program should last from 1990 to 1996. The V6 will replace the old PRV that was mounted on the XMs, the 605s, and the Safranés;
- an automatic transmission. The project began in 1992 and should run until 1996. PSA in particular would like to avoid buying automatic transmissions from the German firm ZF.

Renault and PSA are also involved in seven research projects to develop inexpensive "clean" cars. All of them run from 1990 to 1998. They involve:

- a compression-stroke engine, to produce a compact engine by 1997 or 1998;
- a classic engine, to optimize the efficiency of conventional engines;
- the use of natural gas, to test its energy and pollution savings;
- a gas turbine, to study turbine components (Agata program);
- an electric road vehicle, to study a hybrid vehicle. The program is running behind schedule;
- a hydrogen distribution system, to store and learn how to use hydrogen, which is an ideal non-polluting fuel;
- electrochemical generators, to find a solution to the problem of batteries for electric vehicles.

Despite the poor relations between Jacques Calvet and Raymond Levy, industrial and research programs were initiated. A better understanding between PSA's president and Louis Schweitzer could give new impetus to joint efforts.

BIOTECHNOLOGY

FRG's Riesenhuber on Biotechnology Research, Applications

92WS0716A Graefelfing BIOENGINEERING
FORSCHUNG UND PRAXIS in German Apr-Jun 92
pp 4-5

[Article: "Biotechnology—the Gentle Method of Easing the Stress on and Cleaning Up Our Environment"]

[Text] By using microorganisms it is possible to build up new non-polluting active materials, to destroy substances harmful to the environment and to determine environmental damage. The development potential of environmental biology has not yet been exhausted by far. After intensive discussions with experts from science and industry, the Federal Minister for Research and Technology (BMFT) has thus decided to spend 50 million German marks [DM] over the next 5 years in the Biotechnology 2000 program for research and development projects in the field of environmental biotechnology.

The support will be provided in two rounds of funding applications. Project outlines and applications may be submitted immediately. The goals of the projects that will be supported are:

- Development of new, biodegradable materials in order not to create waste in the first place,
- Improvement of the process of composting organic substances in such a way that garbage compost can be extensively utilized, as well as development of new microbial methods for cleaning up soil and waste water,
- Improvement of microbiological test methods.

According to these goals, it is therefore essential to increase the microbial capability of easing the burden on and cleaning up the environment primarily in three sectors:

1. Development of Environmentally Safe Materials

Biology can help to develop materials which are environmentally safe, for example biodegradable materials. The search is under way for new products in bacterial metabolism with properties similar to synthetics, that is to say so-called biopolymers (such as new polyhydroxybutyric acids, which help reduce the growth of garbage mountains. In garbage composting primarily the process control is to be improved, in order to return organic substances such as macro- and micronutrient elements to the natural material cycle, such as soil ameliorants.

Biopolymers are thermoplastically formable materials created by bacteria which are comparable to synthetic materials but have the advantage of being biodegradable. These substances offer multiple application possibilities. Packaging such as cosmetics bottles, shopping bags, disposable materials (party cutlery, etc.) or office materials such as blister packs, etc. can be produced with them. In medicine it is possible to develop implants, for example to stabilize broken bones, by using biopolymers which dissolve by themselves in the body without side effects after having fulfilled their function and thus make additional operations superfluous. At present the production costs for such biopolymers are still too high, but there is hope that with new microorganisms or by optimizing known microorganisms, at the same time as disposal costs for conventional packaging materials are increasing, the application opportunities for biopolymers will grow.

2. Decomposition of Waste

Biology can also help destroy environmentally harmful materials. Biological breakdown methods rely on the properties and abilities of specialized microorganisms, such as bacteria and fungi, to convert matter. By using them it is possible to largely break down pollutants without these pollutants once again harming the environment in a different way, such as with waste gases (with thermal methods). This makes it possible to

achieve a positive eco-balance. The "cracking" of chlorinated aromatics, which originate in waste water from paint shops or printing shops, can also be anticipated with microorganisms.

Until now the microorganisms under consideration have not been researched to anywhere near their full potential. The speed of the breakdown is also in many cases too slow (biological methods of soil cleanup, for example to reduce oils or dioxin, sometimes need up to 2 years to degrade the harmful materials). Due to the fact that it takes too long to get below the limits determined by the authorities, it is not possible to achieve any cost advantages compared with other non-biological cleanup and restoration methods as well as waste deposits. This is where the new projects in environmental biology will come in:

In order to clean waste water, soil and ventilation air, as well as to clean up existing pollution, efforts will be made to expand the microbial performance potential, that is to say find new biodegradable microorganisms or mixed cultures and to understand and improve their capabilities. It is particularly important to use biotechnology in order to develop representative technical solutions "with the character of a model" in order to break down highly toxic substances which pose a hazard to health, such as alkanes, aromatics and chlorofluorocarbons (CFCs, dioxins, etc.) as well as heavy metals (cadmium, lead, etc.). In cleaning up polluted air, the research need is also aimed at removing particularly disturbing odorous substances.

3. Biological Test Methods

Biology also helps to detect environmental pollution. But at present there are no microbiological test methods which can provide information as to whether there are viable microorganisms for instance in contaminated soils, what their breakdown potential is and which framework conditions must be fulfilled for the optimal decomposition of pollutants (adding oxygen, nutrients, etc.). New types of test methods could also be based on gene probes, which can provide information about the nature of microorganisms. The development of biosensors, which report on the biochemical oxygen demand or specific pollutants in order to determine water quality, is very promising. Such biosensors have the advantage of yielding very rapid results—without expensive laboratory analyses or experiments with fish—about the quality of waste water and provide the basis for making the necessary decisions. Research projects on development and standardization of new microbiological test methods will therefore also be supported, in order to be able to monitor and evaluate pollution, the pollution decrease and the efficiency of the biological methods.

Information and Advice

In view of the numerous small and medium-sized enterprises which are involved in biological methods for cleanup and restoration, there are plans to establish at

the research institutions prototype-like, temporary technology transfer facilities for biological methods to clean up the environment. The purpose of these is not only to introduce and process already known environmental biotechnology methods. It also involves advice from a neutral source, information and training, in order to counteract the uncertainty of those responsible for decisions in municipalities and enterprises, who when dealing with environmental damage often face the question of whether to use biodegradable methods.

Support for Environmental Biotechnology Already Successful

It is an advantage for biological methods that, to a large extent, they can reduce complex pollution in a cost-saving manner and are able to return the residual matter to the natural materials cycle. Progress in environmental protection has already been achieved in these ways:

In waste water purification about 80 percent of the treatment plants today have a biological purification step, some of them with the newest biological methods. Additional measures are needed in order to be able to eliminate special industrial pollutants. With BMFT support it was possible to achieve anaerobic purification of aromatic and halogen-aromatic compounds (such as chlorine, bromine) from waste water from the petroleum industry.

Projects to utilize lyes created in pulp production and waste water from slaughterhouses have been successful. Fermentation processing of highly polluted waste water from potato and wheat starch production has also been extensively developed.

In land reclamation good experience was obtained with microbial cleanup of oil-contaminated soil. There are numerous soils contaminated with oil from leakages, truck accidents, tanker collisions, etc. A BMFT support project for in-situ (on-the-spot) cleanup of sandy soils, which had been contaminated with chlorinated aromatic hydrocarbons, turned out very positive. By adding microbially produced surfactants it was possible to accelerate oil degradation and increase breakdown capacities.

In the joint project called Biological Breakdown of Substances Similar to Dioxin it was possible to isolate in the laboratory microorganisms which are capable of breaking down substances similar to dioxin. It is anticipated that important conclusions will be drawn for the breakdown of the Seveso dioxin by means of biological methods. There is justified hope that this dioxin can also be broken down by biological methods.

In waste water purification, particularly of municipal waste water, and in composting, biological methods are already much more frequently used than in soil cleanup and air purification. Biodegradable materials and microbial methods for environmental monitoring have not been very well researched so far.

Numerous open questions, for example regarding the finding of new microorganisms, which have the desirable, environmentally safe, properties needed in each case, and their optimization, show how much current need for research there is.

Cooperation Between Science and Economy Has First Priority

Joint projects on which companies cooperate with research establishments have the advantage of concentrating scarce resources, achieving technology transfers and synergy effects at an early stage and being largely neutral in the competition. For this reason they have first claim on the funding. R&D projects or proposals for technology transfer establishments in which facilities from the new laender and East Berlin participate are also being given priority. In the field of environmental biotechnology the BMFT intends to cooperate closely with U.S. institutions and organizations, such as the Environmental Protection Agency. It is planned that research and development work should be coordinated in order to concentrate joint knowledge and acquire complementary experience. Project proposals which foresee cooperation with U.S. institutions are thus to be given preferential treatment.

The share of support is guided by the EC's community framework for government subsidies according to the stage of research: For projects in basic industrial research it is a maximum of 50 percent and for projects in applied research a maximum of 25 percent. A bonus of 10 percent is awarded to small and medium-sized enterprises (according to the EC definition companies with fewer than 250 employees and less than 20 ECU [sic] turnover) or applicants from the new laender. The support will be granted in rounds of funding application. The deadline for project outlines in the first round is 30 April 1992, and in the second round 30 April 1993.

German Research on Microorganisms for Oil Wells

92WS0716B Graefelfing BIOENGINEERING
FORSCHUNG UND PRAXIS in German Apr-Jun 92
p 21

[Article: "Microorganisms Increase Oil Production"]

[Text] Hamburg—With conventional techniques it is only possible to recover one-third of the contents of oil deposits. Therefore there is a considerable economic potential in improving oil recovery methods in existence and under development. With broad application of improved recovery techniques an increase in production volume of up to 10 percent of the known oil quantity is expected, which at this time would mean an additional gain in global petroleum reserves of approximately 70 billion tons.

In order to achieve this goal it is necessary to undertake continuous research and additional development on improved recovery methods. These include oil recovery

methods which rely on the specific use of microorganisms in oil fields. The methods are combined under the name of MIOR (Microbial Improved Oil Recovery) and are based on the approach of introducing microorganisms into the oil-bearing layer and inciting them to begin a metabolic process. In this manner metabolic products such as polymers, biosurfactants, gases or acids are produced in the pore space of the oil carrier (in situ), so that later, by influencing the mobility of the oil phase or the permeability of the rock, it will be possible to remove the oil.

The Federal Minister for Research and Technology (BMFT) seized upon this subject in early 1988. The results of the first preliminary investigations were presented in 1991 in the form of a study. This includes the present state of knowledge of all MIOR methods and creates the foundations for continuing, extensive research work.

The study arrived at the conclusion that the introduction of microbiology into oil recovery initially necessitates a multi-phase research program with close cooperation, based on the division of labor, between research institutions for microbiology and petroleum technology including the petroleum recovery industry. The program was begun at the end of 1991 with two projects on the microbiological foundations and a field trial in Romashkino/Russia. The scientific work by the higher education institutions and research institutes was coordinated by the German Scientific Society for Petroleum, Natural Gas and Coal, reg. assn. (DGMK) and the field trial was undertaken by Erdoel-Erdgas-Gommern GmbH and VEBA OEL AG. The BMFT supports the project until 1994 with about 7.5 million German marks.

The focal points of the research work is:

- Specific search for anaerobic or facultative anaerobic bacteria including nitrate reducers, which remove the various stress conditions at the site (elevated salt concentrations, elevated pressure, elevated temperature, etc.) or combinations of these and under these conditions are still able to separate out MIOR-relevant products.
- The MIOR-relevant metabolic products must be chemically described. Further, it will be necessary to determine the chemical and physical properties of these materials. In particular, viscosity and surface activity are of interest.
- In model systems (sand packings saturated with deposit fluid and core materials) the previously selected strains or their metabolic products must be tested as to their effect on the degree of oil removal that can be achieved. Transportation processes in the pore space of the materials used must also be studied with the help of such models.
- Of major interest for use in oil deposits is the stability of primary and secondary metabolic products under local conditions.
- In laboratory tests designed for corresponding circumstances, the influence of various stress conditions

(pressure, salt content, temperature) on the metabolic performance of the MIOR-relevant bacterial strains will be studied.

- Special study of site-specific materials which can be employed as substrates for bacterial metabolism.

In the FRG there has so far been little experience with MIOR application. Since in comparison with other recovery methods the cost for expensive chemical flooding additives will be eliminated, the MIOR method is expected to bring a more economic improvement in oil recovery. The particular risk with these methods lies in the complexity of the process control.

Brittany: Systematic Detection of Cystic Fibrosis Gene

92WS0723B Paris LE MONDE in French 8 Jul 92 p 15

[Article by Jean-Yves Nau: "Toward an Eradication of Cystic Fibrosis"; first paragraph is LE MONDE introduction]

[Text] Breton doctors are launching the first systematic effort to detect the gene responsible for this serious inherited disease, without referring the matter to ethics bodies.

A group of Breton doctors and biologists have just launched an unprecedented drive to systematically detect the gene for cystic fibrosis, the most common genetically-transmitted human illness. The initiative is a vital step in the history of the battle against this extremely crippling and nearly always fatal disease. At the same time it raises a set of very delicate questions, linked to advances in the field of medical molecular genetics.

Is it possible to launch such a drive, which ultimately aims to eradicate a hereditary disease, and escape the facile charge that one is practicing eugenics? Dr. Claude Ferec's team of the Brest Blood Transfusion and Biogenetics Center is aware of the difficulties. After giving the matter much thought, it has just decided to go ahead with its testing without referring the case to ethics bodies. Will those bodies intervene, and if so, how?

Cystic fibrosis, the most common of hereditary illnesses, was difficult to diagnose until the 1950s, due to a lack of objective biological signs. The disease strikes one child out of 2,500 in the populations that are most affected. In 1985, researchers attempting to decode the genetic bases of the disease pinpointed the gene whose dysfunction causes the physiopathological molecular cascade that underlies the clinical symptoms. And 3 years ago, the gene was identified through a remarkable American-Canadian joint effort (see LE MONDE, 26 August 1989).

But things quickly proved more complicated than scientists might have hoped. Researchers know that the identified gene controls the synthesis of a protein dubbed CFTR (cystic fibrosis transmembrane conductance regulator), which plays an essential role in transporting

chlorine ions across cellular membranes. A very frequent mutation (the loss of an amino acid in position 508 of the protein, or delta F 508) was found in 70 percent of the cases in which the gene mutated. But 150 other molecular anomalies were described, thanks to an exemplary team effort involving 100 laboratories around the world coordinated by Dr. Lap-Chee Tsui of Toronto's Children's Hospital.

"This extraordinary diversity combined with the complexity of the gene's molecular pathology has not given the medical and scientific community much reason to be optimistic over the last 2 years," explains Dr. Ferec. "Indeed, there was no certainty that carriers of the mutated gene could one day be effectively identified, since in most countries only 70 to 80 percent of the mutations could be analyzed. Last October, the American Human Genetics Society recommended postponing testing for carriers in the population until such time as over 90 percent of the gene's mutations could actually be detected."

But Dr. Ferec's team has just published important findings in the monthly review *NATURE GENETICS*, showing that it is possible to identify over 98 percent of the CFTR gene's mutations in a homogenous population². Their work became possible after researchers simultaneously explored the structure of several areas of the gene where most of the mutations had previously been localized. The researchers in Brittany analyzed over 365 chromosomes. The chromosomes were mutation sites in blood samples that had been taken from 191 patients whose Breton ancestry had been traced back for several generations. The primary mutation, delta F 508, was found in 81 percent of the cases. With their discovery of 19 other mutations, Dr. Ferec's team achieved the remarkable coverage rate (percentage of detectable mutations) of 98 percent.

"These findings show, for the first time in a large study, that nearly all the mutations of the cystic fibrosis gene can be characterized," says Dr. Ferec. "Collaboration with other teams enables us to say with some confidence that our results could be duplicated in other European countries—England, Ireland, or Denmark—where the gene's mutations are the most frequent."

Roscoff and Pont-l'Abbe

Ten million Europeans are presently unwitting carriers of a mutation of the cystic fibrosis gene. The disease is especially frequent among the populations of Northern Europe and among their descendants in the United States and Canada. In practice, the risk of giving birth to an afflicted child is 25 percent when each of the two parents bears a mutated gene.

"It is now clear that we can set up pilot centers to test for mutations of the gene, where those concerned—volunteers—could be analyzed. If they are carrying a mutation, they can receive genetic counseling and be informed of their couple's risk of giving birth to an affected

child," stress the scientists in Brest. "Such testing performed throughout Finister, where about 10,000 children are born each year, would make it possible during the first year to identify and inform 20 couples likely to produce one child in four with the disease. What's more, the same could be done for 500 carriers of the mutation and, consequently, their relatives."

On the basis of these data, the Brest team has just set up such a system in a Breton region near Roscoff that is known to have one of the highest risks of cystic fibrosis. Initially they will collaborate with 15 general practitioners. The current data suggest that testing could be useful only in regions where the distribution of mutations is relatively homogeneous, despite the diversities. There is thus reason to be wary of the many commercial proposals that vaunt the merits of "detecting" a limited number of mutations, since this does not offer any certainty³.

Other "centers" of cystic fibrosis have also been pinpointed in Brittany, in the regions of Pont-l'Abbe and Morbihan. The other fascinating aspect of the work being done in Brest is the highly unusual association of molecular biology and genealogy. Andre Chaventre of the National Institute of Demographic Studies is already very well-known for his work on glaucoma and manic-depressive psychosis (see *LE MONDE*, 3 April, 1991). Fruitful collaboration with Mr. Chaventre enabled researchers to shed light on a wholly unknown dimension of the gene's mutation distribution. When the genealogical and molecular data were pooled, a "founding effect" for Brittany for the majority mutation and for the four other most common mutations was established. In other words, researchers are now certain that today's mutations result from the introduction during the first millenium of a mutated gene from Ireland and from blood relationships linked to intra-parish marriages.

If scientists pursue this line of research, it will not be long before they are able to plot an unprecedented map showing the distribution across time and space of the genetic mutations underlying the most common of hereditary illnesses. But continued work will also make increasingly clear how paradoxical it is to pursue a program to eradicate cystic fibrosis through systematic testing and prenatal diagnosis: For the first time ever, progress in molecular biology is on the verge of producing an effective therapy against the disease, which we now know is not due to blind chance.

Footnotes

1. Cystic fibrosis is characterized by a set of highly crippling digestive and pulmonary symptoms, caused by the glandular secretion of abnormally abundant and thick mucus. The nearly inevitable result is gradual progress toward fatal respiratory insufficiency. Over the last few years, different French surgical teams have attempted heart and lung grafts in certain cases (see *LE MONDE* 10 August, 1990).

2. "Detection of Over 98 Percent Cystic Fibrosis Mutations in a Celtic Population", Ferec et. al, NATURE GENETICS, 1992 (1,188-191). The reader may also refer to Kevin Davis's editorial in the June issue of NATURE GENETICS.

3. The cost of testing a couple in Brittany is presently estimated at 1,000 French francs [Fr]. It should drop when tests are run in greater numbers. The Cystic Fibrosis Research Association of Brittany will finance the tests. Brittany department's general council, mutual insurance company, and basic health-insurance fund may also help defray the costs. The cost of medical care for a child with cystic fibrosis is generally estimated at between Fr2 and 4 million.

COMPUTERS

Germany: Hewlett-Packard's New Server Said to Replace Mainframe Computer

92WS0659A Duesseldorf VDI NACHRICHTEN
in German 29 May 92 p 32

[Article by Egon Schmidt: "Midget Powerhouses on the Attack"]

[Text]

Minicomputers Want to Replace Mainframes

Hewlett-Packard Attacks Classic Mainframe Manufacturers

While expensive mainframes have ruled the world of company computer centers until now, the old mainframe domination appears to be disappearing faster and faster. The newest attack by the traditional minicomputer manufacturer Hewlett-Packard (HP) also demonstrates this. The company now wants to shake up IBM and company with new models.

Eckhard Braun is the managing director of HP. Advanced minicomputers based on RISC [reduced instruction set computer] processors and using the Unix operating system may be "about 80 percent cheaper to purchase and operate than conventional mainframes," explains Braun. Unix is often declared to be an open operating system. Savings of 50 percent can be achieved for program licenses and maintenance. For these reasons, Braun sees a good chance for a new series of servers. These machines "provide all the advantages of traditional mainframes" without any of their shortcomings. The responsible sales manager is Axel Lange. He emphatically differentiates the systems from conventional mainframes, even if he would now like to see them rapidly move into the data centers of large companies replacing the mainframes there.

Lange lists a few advantages of the new servers. For example, they only need one or two operators while computer centers of comparable significance today need five to ten times as many people. Besides, they are up to

ten times cheaper to buy. As they are air-cooled machines, they are simpler to install. Traditional mainframes of the same performance class still require large rooms and expensive water-cooling systems. While the mainframes of central data processing departments use star-connected terminals, the new systems of the HP design apply advanced Client-Server computing principles.

According to Lange, the new 3000 and 9000 series HP machines use an internal bus with a data rate of 1 Gbyte/s. These machines can accommodate a maximum of four (RISC) processor units. They have up to 2 Gbytes of main memory and 690 Gbytes of disk storage. They can handle a maximum of 3000 users. They can be upgraded in place to the next larger model of their series and cost around 750,000 Deutsche marks or 2.6 million Deutsche marks. These models will handle at least 110 transactions per second, up to a maximum of 400 transactions per second. Test runs in conjunction with an Informix data base have demonstrated these actual numbers.

"HP developed its first RISC processors around 1985/86 and has increased the computing power of these processors by 75 to 100 percent per year since then," said Lange in a brief review of the historical roots of the new computers from Boblingen. Even now, the engineers of the company expect to be able to continue this performance advance. Lange sketched this using a few ideas for the future. As early as 1993, new chips will provide an additional increase of 50 percent. By 1994, the integer and floating-point units will be combined onto a single chip. This will add more speed. The transition to super-scalar processors will produce machines performing at about 3000 MIPS (million instructions per second) by the year 2000. Super-scalar processors are computing engines of different specialization working in parallel and integrated onto chips. Lange predicts all this full of optimism. This corresponds to about 60 times the speed of current workstations.

However, not only should the individual processor chip become faster and faster. Machines with several parallel processors also will provide a large performance boost. Lange expects HP computers having 64 processor units by about 1995. These units will have 32 Gbytes of main memory. For the year 2000, Lange even awaits machines with double this number of processors. Consequently, servers with about 20 times the performance of current top-of-the-line models of the company can be anticipated.

The following statement is of interest because the 3000/9000 machines from HP primarily have their sights set on the general-purpose IBM-type computers. By 1994, Lange wants the newest machines of his company, then, to be "as fast as the mainframes of today." The HP machines are said to be able to manage 800 Gbytes of disk storage by next year and 1.4 Tbytes by 1994.

These current HP perspectives need not be fantastic in spite of the impressive numbers. A brief review of similar projections by the old minicomputer champion DEC shows this. The HP rival speaks of a greater than one thousand-fold performance increase within 25 years. This is in conjunction with its new 64-bit Alpha RISC processor. At this time, this processor claims to achieve a maximum of 400 MIPS at 200 MHz. These projections also call for clock rates up to 2 GHz. Consequently, interested parties may look forward to exciting competition for the title of the performance champion over the next years. This will take place in a tournament with even semiconductor heavyweights such as Intel, IBM, Motorola, Sun, and MIPS. These and others will each participate with their own processor designs.

Germany: Progress, Problems With Fuzzy Logic
92WS0701A Landsberg PRODUKTION in German
11 Jun 92 p 3

[Article by hap: "Counter to the German Mentality"]

[Text]

Mentality—Drag on Fuzzy Technology?

Fuzzy logic has been the buzzword in all the media over the past 2 years. Will the technology really live up to this ballyhoo as a control-engineering panacea or is fuzzy logic only a practical tool for a very limited set of applications? At the beginning of May, the technical world expressed its view at a conference organized by the Institute for International Research.

"The media produced tremendously high expectations," says Dr. Jorg Thietke, almost complaining about the whirlwind surrounding the fuzzy logic phenomenon. He is a project leader for Prognos AG. He is working on a study on the market development and the strategic aspects of control-engineering applications for this technology. "There is now enormous tension between product manufacturers and consumers," according to Thietke. "While manufacturers of components for measuring and control technology complain about the lack of tasks specified by consumers, users demand concrete demonstration products from the manufacturers."

Fuzzy fever broke out without warning in this country. The successes of fuzzy applications reported in Japan have become firmly entrenched in the minds of engineers and, above all, marketing strategists. They must watch powerlessly as applications have advanced the fuzzy philosophy in Japan to a sensational advertising subject. These applications are in elevators, camcorders, washing machines, and the Sendai subway that is known throughout the world. Products, even including a toilet paper named Fuzzy, are profiting from this.

Fuzzy experts here in this country have wished for a PR ballyhoo like this for a long time. Prof. Hans-Jurgen Zimmermann is the director of the Institute for Economics at the Rheno-Westphalian Technical College of

Aachen. With his team, he has been doing research in fuzzy set theory virtually unnoticed in the past. While Japanese philosophy always placed a high value on shades of truth, Zimmermann has fought for years against the German mentality of absoluteness. Uncertainty, or fuzziness, "was absolutely despised until 5 years ago," he reports. Consequently, it is no wonder that, although the theory has been around for a while, "almost all applications have been created in the last 2 years."

Only "the change in the paradigm of mentality," according to Zimmermann, smoothed the path for fuzzy logic. "Fuzzy logic is no longer a bad word, but a fact with which we must live. This has finally been recognized," says the German fuzzy logic guru, optimistically.

The prognoses support Zimmermann's confidence. "The market volume for fuzzy products and applications in the area of process automation alone will be about 100 million Deutsche marks in 1995," concludes Jorg Thietke from his current studies. He expects that the 500-million-Deutsche-mark limit will be exceeded by the year 2000.

The high growth expectations are based on the fact that leading German manufacturers of components and systems for measurement and control engineering are working at fever pitch on the implementation of fuzzy logic applications. Characteristic for this development is the growth and key area of industrial automation. Specifically, these are programmable control systems with the associated market of the entire capital goods area, thus the building, process and machine automation sectors. Besides the Japanese fuzzy logic pioneer Omron, the market leader Siemens has also offered a programmable control system using fuzzy logic since the Hanover Fair 92.

While the industrial equipment manufacturers may be pioneers, they are not alone. More than one-half the German conglomerates are working on the implementation of specific products and applications or at least have this planned. By 1995, as many as 95 percent will be working in this area. If high-performance hardware such as processors and an increasing array of software will be available soon, Thietke believes that fuzzy logic will play a role in solving up to 20 percent of all control problems in 10 years in Germany.

"The acceptance barrier no longer exists," says Thietke, supporting Zimmermann's conviction. However, the great euphoria of the last one and one-half years has changed to a critical attitude of anticipation. "It quickly became clear that it is very difficult to abstract from the standard examples presented in the literature and in seminars."

Constantin von Altrock is the business-sector director at Inform. He shows such a standard example. He presents the model of a crane trolley such as that used by container cranes. The system consists of a freely

swinging hammer as the load and a drive system powered by a direct-current motor via a toothed belt. The desired position is approached without overshoot at an accuracy of about 1 mm. Even interference while moving and approaching with the load already swinging has no effect.

Altrock admits that there is also a conventional solution to this control example. However, fuzzy logic represents a much simpler solution. Consequently, a mechanical-engineering student with a knowledge of control technology and 4 weeks of work with fuzzy technologies expends only 5 hours of work on the fuzzy logic crane trolley. This time includes the language, the variables, the controls, testing and optimization.

However, fuzzy logic is in no sense a control-engineering panacea. "It is suited to systems with large fluctuations in interference and other parameters, nonlinearities, continuous-time behavior, nonobservable measured variables and controlled variables, or for systems with complex sensor processing beset with tolerances," says Prof. Gunter Pritschow, attempting to limit the areas of application. He is from the Institute for Control Engineering of Machine Tools and Manufacturing Equipment in Stuttgart. However, even when the cost and simplicity of an implementation are the most important factors, using fuzzy logic is feasible. "Only when the task becomes more complicated is a knowledge of control engineering necessary with fuzzy logic. The control-engineering layman quickly hits his limits," emphasizes Pritschow, stoking the high expectations.

Users' experiences have shown that there are two main advantages of fuzzy logic. These are the quick design of robust controllers with minimum expenditure, and the inexpensive realization of multicomponent control systems. The simplified control systems have inherent economic advantages coupled with the potential of new, intelligent features. Thus, they provide clear competitive advantages. Process engineering system users expect, for example, an increase in productivity of between 2 and 5 percent and thus a very high potential for reducing costs.

So far, so good. Only time is in short supply now. The Japanese competition has a few years' lead over the European economy with applications in the area of fuzzy controls. In the U.S.A., the scientific work in the area of fuzzy sets has a history as long as that in Europe. The acceptance and practical application of these techniques appear to have begun this year in the U.S.A. Experience has shown that the Americans do not delay providing products as long as the Europeans. "We hope that the Europeans can maintain their lead in fuzzy data analysis and fuzzy expert systems while reducing the lead in fuzzy controls," clarifies Prof. Zimmermann. Prerequisites are that the Europeans can coordinate their research better, provide attractive problem solutions with industry, and achieve a very intensive knowledge transfer. "Because," in his conclusion, "the necessary 'brainware' is still lacking in the broad mass."

EC Chooses UNIX System V for ESPRIT "Project Overture"

92WS0709A Munich *COMPUTERWOCHE* in German
10 Jul 92 p 4

[Text] Munich—The EC Commission has started "Project Overture" in order to develop microkernel technology for real time applications and parallel processing. The commission draws only on UNIX System V, Release 4 (SVR4), and the Chorus microkernel, while there is no reference to the Open Software Foundation (OSF) and its development of Mach.

Participants in "Project Overture" include the companies of Alcatel-Alsthorn, Chorus Systemes, Olivetti, SGS-Thomson, Siemens-Nixdorf Informationssysteme (SNI) and UNIX System Laboratories. Together they and the EC have raised a capital fund of 14 million ECU for the project.

With Overture the EC hopes, as stated in a press statement issued jointly by SNI, "to be a decisive participant in the future development of operation system technology." The center of the project is better integration of microkernel technology into the SVR4 environment and optimization of this environment for applications in the area of massive parallel processing, for systems with high accessibility and for real time solutions. Within the framework of the projects the microkernel developed by Chorus is to be complemented by object-oriented interfaces.

Project Overture is part of the ESPRIT program of the Commission of the European Community. Jean-Marie, Cadiou, director of ESPRIT, explained about the connections: "Overture is particularly significant for the newly designed Open Microprocessor Systems Initiative (OMI)," which deals especially with integrated real-time systems.

Further, Cadiou expects that "the project will play an important roll in the area of high performance computing (HPC) under ESPRIT III."

Remarkably, there is no mention in the official statements of OSF, its operating system OSF/1 or its microkernel concept Mach. Instead, those participating in Overture, including OSF member SNI, call Chorus/MIX "the de-facto standard in microkernel architecture." The next sentence in the statement speaks of the "industry standard for open systems, UNIX System V, Release 4, from UNIX Systems Laboratories."

The EC's choice of SVR4 rather than OSF could have far-reaching consequences. When Bob Mitze, European head of USL, refers to "the strong role which Europe has to play in the further development of business with open systems" it is not only a compliment to Brussels. Hubert Zimmermann, chairman of the board for Chorus Systemes, expressed similar hopes: "This will strengthen our position as well as USL's."

A statement by Klaus Gewald, the director of system technology developments for open systems with SNI, tends in a similar direction: "Project Ouverture could give significant impetus to innovation for UNIX SVR4 technology." Gewald indirectly gives the reasons for SNI's departure from OSF and its return to the USL-led System V community when he says that "this would be of great value for our palette of SINIX products based on it."

Germany: Expert System to Determine Electronic Signal Box Configuration

92WS0709B Munich *COMPUTERWOCHE* in German
10 Jul 92 p 45

[Article by Klaus Groth, project director for Teknon Co. For Knowledge-Based Systems Ltd. in Darmstadt]

[Text] In the railway division of SEL AG, Stuttgart, electronic signal boxes are being planned for railway installations and stations. Previously a team of experts would determine the necessary material by hand and establish the configuration. Now the planners are working with an expert system.

The tasks will be carried out according to the following timetable: the basis for the planning of the railway installation is the so-called "Element Linkage Plan," EVP for short. In it the necessary switches, signals and tracks and their logical connections are modelled.

Before the layout is configured, the data of the connection plan have to be tested.

Then the components of the external installation are determined and the control of the track layout are completely configured.

The results of these tasks are configurations and material lists for the internal and external installation as well as an estimation of power use.

Well-founded knowhow and experience are important prerequisites for these time-consuming and complex tasks.

In order to process contracts more rapidly in future and to reduce the burden on the planners, a need arose for the installation of a knowledge-based system for automatic planning of installations.

Implementing this was assigned to an external software house. In the period from September 1990 to December 1991 an expert system for projection and material (PRO-MAT) was developed. In the framework of these activities an integrated data bank application (ORACLE) was also created. The system was implemented on VAX 3100 and VAX 6320 using VMS.

The tasks of the new system, individually listed, are:

1. Testing of the EVP. 2. Material acquisition for the external installation. 3. Material acquisition and configuration of the internal installation (operating the railway layout). 4. Performing power use calculation.

For testing the EVP, rules are introduced. The conditions are very complex. New conditions which can deviate from previously established complexity and structure can be defined easily using rules. By use of rule classes these rules can be better structured, which also makes for greater clarity.

The system lists materials for all components necessary for the external installation independently, based on EVP data.

In material acquisition and configuration of the internal installation the system for planning and material acquisition combines the components supplied into a total system. In the process the technical boundary conditions are taken into account. This is the actual task of configuration. Then internal wiring is determined accordingly, and data for dimensioning the power use are obtained.

In doing this a large number of conventions and boundary conditions must be observed.

The list of configurations and materials for the inner and outer installation and the results of the power use calculation are stored in the data bank for further processing and for archivization. In planning, the expert system also takes into account the characteristics specific to the client which can lead to different types of structure, e.g., for the German Bundesbahn or for export.

The center of the expert system is the knowledge base, which contains detailed information about the material requirements and configuration of electronic signal boxes.

System users work at VAC 3100 work stations which are linked with one another and with the host computer via DECNET.

The following information is represented:

- Information about the installations to be planned (descriptive information). What are the components of electronic signal boxes? What are the relations between the components?
- Information about how to proceed in material acquisition/configuration and about availability of supplies. How is configuration/material acquisition done? How are special cases such as export processed? How is testing of the EVP carried out?

The data bank interface carries out data transfer between the expert system and the data bank application.

The expert system requires the following information from the data bank: client data, information about

availability or about the job and further information which is entered into the system interactively through the user interface.

The accomplishment of this project shows that economical solutions can be obtained using knowledge-based systems if the task is clearly defined and the development is carried out professionally. This is particularly true for tasks of planning and availability for complex systems.

The work time saved for the SEL planners, according to the division chairman, is now 30 percent, and he also says that consistently high quality has been achieved.

Knowledge-based technology permits exploration of changed conditions and relationship without the need to adapt the program code for them.

German Firm Develops Integrated Cache Disk Array to Replace IBM Mainframe Technology

92WS0709C Munich *COMPUTERWOCHE* in German 10 Jul 92 p 20

[Text] Eschborn—EMC Computer Systems announces macrocomputer technology for AS/400 systems with the disk subsystem "Hormonix ICDA." Two models are being offered.

IBM recently announced a performance improvement of more than 70 percent for the central processing units of its E models. "But Big Blue doesn't have any storage components which would permit the client to make use of this improved performance," claims German managing director Wolfgang Dembowy. EMC hopes to offer a storage system with powerful I/O capability for these users with the ICDA system (Integrated Cache Disk Array).

According to EMC, the ICDA technology was originally developed for the Symmetrix disk storage of the IBM mainframe world, and it offers data access at semiconductor speeds. Along with the reading cache, which can be expanded to 128 MB as needed, there is also cache writing storage.

The storage specialist points particularly to the high data integrity of the systems. Along with error diagnosis routines, the storage solution has functions like "Dynamic Disk Spare Option" and "Disk Scrubbing" available to it. These features are meant to test the disks for potential error sources and, if necessary, execute new configurations. In addition, data which are stored on a disk in which the system discovers many temporary errors are transferred to a backup drive. Linkage of the system components is achieved via a midplane connector and not with conventional cables. Thus EMC claims that it is possible to repair or upgrade individual components even online.

The HX5 model works with 5 1/4 inch drives and offers a storage capacity of 6.8 GB per insert. For the AS/400 user the basic equipment provides cache storage of 4

MB. Disk expansions are possible in 1.7 GB steps. It is stated that the HX3 variant is intended for users who are confronted with troublesome bottlenecks in the I/O area or with high transaction rates. This subsystem offers a maximal storage capacity of 6.8 GB and cache storage of at least 32 MB. The storage capacity of the disks can be expanded in 857 MB steps. Both disk storage systems are compatible with IBM's 9336 machine.

German Researcher Developing AI With Neural Networks

92WS0728B Landsberg *PRODUKTION* in German 17 Jun 92 p 3

[Unattributed article: "New Initiatives Remote From the Think Tank: AI: Is the Era of the Independent Beginning?"; first paragraph is PRODUKTION introduction]

[Text] Dachau (beu)—Artificial Intelligence (AI) has not yet made the leap to industrial applications. What is lacking is practical software architectures. Nowadays new initiatives for improved AI systems are coming increasingly from outside the university community. With extremely simple means and without academic "ballast" specialists are independently creating intelligent algorithms with which associative data bases and even image and voice processing can be constructed without elaborate programming standards.

The euphoria over intelligent machines which master far more than monotonous crunching of infinite columns of numbers blew over long ago among the experts. "The performances of a few systems are certainly quite impressive," critiques Manfred Hoffleisch, "but what is lacking is a general theory which will reduce all this to a common denominator."

The electronics expert and autodidact from Dachau near Munich has been working intensely for 3 years on such a universal theory. His reflections are directed at an intelligent software architecture which bundles characteristics of neural networks such as trainability, self-organization, and abstraction capabilities with the knowledge of expert systems in one system. In this endeavor, the Bavarian software expert is in no way basing his work on the preconceptions of computer scientists from academic institutes. His premises are extremely less complex rules: "I sought a principle outside standard computer science," the electronics expert confesses.

Working alone, without academic support, the software developer hit upon an algorithm which he calls the ur-principle of intelligent activities. "It could revolutionize computer engineering in a short time," states the software expert without presumptuousness. There is no complex mathematic set of rules encoded on a sheet of paper, but rather a simple prescription for processing huge quantities of data. "This is not some program which I wrote," explains the computer expert, "but rather a quasi natural principle."

Hoffleisch uses the expression "ur-algorithm" to characterize a rule of integration which distills meaningful structures from heterogeneous quantities of data. With a few elements of meaning the system can already be stimulated to perform associative processes. Quickly, the computer develops a fine-meshed, infinite autohierarchical network of relationships which (according to Hoffleisch) "very closely imitates" the function of neurons in the human brain.

The self-organization of the elements of meaning into a fixed, dendritic matrix entails an additional advantage: The hierarchically structured elements of meaning do not respond to a preprogrammed distribution of levels "but form hierarchies, by themselves, with variant and invariant regions" (according to Hoffleisch). This differentiation into variant and invariant data structures is significant for the trainability of the system: For example, from the incoming flood of optical data the system extracts both specific elements of meaning such as nose, mouth, eyes, and ears and general relationships, in this case face.

The fundamental algorithm is derived from a basic principle which Hoffleisch maintains represents "a general basic function for intelligence and all activities linked to it." This recipe for evolution, and Hoffleisch is absolutely convinced of this, is the basic key to the capability of the brain to file impressions delivered via the sensory organs as specific structures and to use them again.

"This resembles a power-knitting machine which interweaves the threads into designs with differing colors," Hoffleisch explains his discovery far from the beaten path of research. A linkage of meaningfully associated quantities of data which are combined, without interventions from outside the system, into specific patterns of meaning by a simple functional principle is transferred to data technology.

Compared to the tremendous advances in modern computer technology, the search for intelligent algorithms for the generation of artificial thought is just beginning. In the traditional spectrum of AI developers, practical solutions are only very timidly starting out. A mere handful of companies offer marketable system integration of neural networks and fuzzy logic for to process image data. In most cases, neural systems start from preprocessed image data and calculate deviations of unfamiliar pixel patterns from reference patterns which were taught and stored in memory. Specially trained programmers, who convert the system to new measurement and error criteria, are required for any change in the assumed conditions and the object to be tested.

The most significant handicap of current applications is the high computer outlay required. To make human expertise available in machine form, legions of computer scientists are plunging headlong into the improvement of hardware. With enormous storage volumes and multiple

processing units, so it is hoped, increasingly more processing and transformation programs can be implemented and the trainability of the computer can be increased. With moderate success, as Kurt Ammon, computer scientist and researcher at the Institute for Artificial Intelligence in Hamburg, explains: "AI researchers believe that it is necessary to organize how it will work in advance at the drawing board. However thinking is not something static, but rather a dynamic self-driving process."

It is no wonder that increasing numbers of software experts are setting off on their own research paths independent of rigid mathematical rules and clearly structured programming. Data banks offer a starting point for intelligent solutions: For example, no one would have the idea of emptying his suitcases before checking in his baggage, hanging a label on each individual piece, and then checking in the thus fragmented contents. But that is how relational data bases operate in the filing of data. "A typical case of the lack of abstraction capabilities," says Hoffleisch.

One of the great hurdles of conventional programming methods is set- or table-based processing. A data bank system constructed in this manner cannot get around drawing up its own algorithm for each computer operation. According to Hoffleisch: "Today's programmers are going at artificial intelligence in the wrong way." Classical algorithms, which are nothing more than mathematical rules for the solution of a specific problems, subject quantities of data entered to a rigid calculation process. However, there are usually more relationships in the source data than can be found by the algorithm written by the programmer. From this Hoffleisch concludes: "True artificial intelligence is not feasible with mere algorithm machines."

The principle propagated by Hoffleisch processes data not as homogeneous units of information which are sequentially subjected to an addressing mode and filed in memory. Such processing of data generates isolated structures whose content linkage is not produced until later through programming. True conclusions cannot be reached in this manner. His unique way out of this dilemma: The source data captured in the input level are already captured according to their qualitative aspects, linked, and filed in mass storage as meaningful structures.

Such a self-generating knowledge base is capable of creating an overall picture from partial data, without the linkage process being influenced by any mathematical rule. The algorithm discovered by Hoffleisch follows this very model. When data pass through the two-stage ur-algorithm, structures containing everything within them are created. Newly entered data are compared with the existing knowledge base via microroutines and integrated into the system. In this process, it makes no difference what kind of data are fed into the system. It seems absolutely sensational when Hoffleisch talks about the system neutrality of his algorithm. Whether in the

form of a digital video signal, ASCII code, or even spoken words as sound frequencies—the linking mechanism searches for structures of meaning in every group of data. And at the end of the procedure, the system conjures up on the monitor a table of the structures discovered, specifies the degree of similarity between existing and new patterns, and reports the names of the structures to the questioner.

The fact that Hoffleisch is not merely hatching up impracticable theories, but can actually serve up hardware speaks for the developer's practical sense. Resplendent on his workbench is a board with chips and conductors which responds to his *ur*-algorithm. Astonishingly, Hoffleisch needs neither super computers nor souped-up parallel computers. The add-on board fits in any PC-AT. Even so, the hardware links 1.2 million elements of meaning (neurons) with up to 40 million links (synapses). The simplest version of the associative memory runs with a 12-megabyte cache. Expanded versions with 48 and 96 megabytes are in preparation. The current software version can link 65,635 neurons with up to 2 million synapses and costs approximately 1,500 German marks. Hoffleisch the expert already has his next high-flying future plans on the table: "I am working on voice and image recognition systems which will recognize not only the content of words, but their speaker as well."

DEFENSE R&D

Germany: MBB To Launch First Prototype of Eurofighter Successor By the End of 1992

92MI0671 Bonn DIE WELT in German 6 Aug 92 p 3

[Article by Peter Schmalz: "A Plucked Bird Is—Nevertheless—Being Prepared for Flight, Regardless of Political Resistance, MBB Engineers in Manching are Keeping the F-90 Alive as the Prototype for a New European Fighter Aircraft"—first paragraph is DIE WELT introduction]

[Text] An air of restrained optimism pervades the test hangar near Ingolstadt: work is continuing at MBB on the German share of the F-90 project, which is worth billions. Rollout is scheduled for the end of this year.

The hangar is the holy of holies. The pass that raised the barrier at the high-security entrance to the site means nothing at this iron door. The words "security zone" glow upon it, red and forbidding. Within, two Tornado fighter-bombers, dark green and each weighing 14 tonnes, are being serviced. These two aircraft catch the eye, diverting it for a brief moment from the ugly duckling over in the corner to the right.

There sits a plucked bird: The pointed beak at the front is missing, hundreds of colored electronic cables dangle from open hatches in its belly, its body and wing surfaces are painted in dull shades of brown, yellow, and green. Although the F-90 has swallowed the equivalent of 20

billion German marks [DM]—seven of them from the German treasury—in development costs, and a good 200,000 hours of painstaking work have been performed in the UK, Spain, Italy and, above all, at the Bavarian high-tech company, MBB, the preliminary result, which is now being carefully concealed from the public, in the test hanger in Manching near Ingolstadt, looks either majestic or threatening.

"It's the first prototype," says Erwin Obermeier, MBB Aircraft Division's program director for the EFA, which stands for "European Fighter Aircraft" and is the acronym used internationally for the F-90. A second prototype is being built by British Aerospace in Warton, but the Germans are in front: They started on final assembly 3 months earlier, although the British are now noticeably narrowing the gap. According to Erwin Obermeier, this is both desirable and logical: "We are in very close contact, so the British learn from our mistakes and can avoid making them themselves."

For some days, British specialists have actually been at work here at MBB. They are fitting out the cockpit, which is part of the British share. Its jumble of wires has to be carefully connected up. A good two meters above the floor of the hangar, the loaned British workers are creating one of the most remarkable workstations in the world: The future pilot will be flying a machine that accelerates up to twice the speed of sound, whose delta wings and the wing butts close to the cockpit enable it to withstand the most daredevil flight maneuvers, but which reacts much too sensitively for it to be exposed to human inadequacies. This is why four independent computer systems check each pilot command—and ignore it, if at least three computers decide that only a refusal to execute the command will save both man and aircraft.

Such insubordination in the most extreme situations aside, though, the quartet of computers plays the role of the good fairy, ensuring optimum positioning of the control surface and tail plane, and, if necessary, extending, directly behind the pilot capsule, an air brake that withstands 270 kg/cm² helps change the position of the aircraft in a split second during aerial combat. The computers also locate the positions of up to 12 enemy aircraft for the pilot, and tell him which of them poses the greatest threat to him. He does not even need to look down while this is happening, because the information appears on the glass of his cockpit dome. He will also see there the circle in the center of which he will endeavor to engage the enemy. "Then it's fire quickly and away, before the enemy can retaliate."

Erwin Obermeier bubbles over with enthusiasm in his typical Bavarian accent. In his view, it would be virtually impossible to improve on what up to 180 experts, working in three shifts, have created in 9,000 working hours: "Maximum lift, with minimum resistance," by which, of course, he only means air resistance. "This is

the lightest aircraft in the world in its class. You couldn't find a lighter structure anywhere." Less than 10 tonnes: "Perfection."

The engineer does not wish to comment, however, on why the new Defense Minister in Bonn, Volker Ruehe, does not share his enthusiasm, although he would undoubtedly like to conduct the impetuous young minister around the unfinished prototype, crawling under the wings with him, and showing him the specially developed undercarriage, which is another small miracle of technology, and scarcely needs further modification, let alone improvement.

Of course, everyone would be very polite to the minister, and would not tell him what the German EFA experts have been hearing for weeks from their colleagues in Britain, Italy, and Spain, which is said to be scarcely flattering to the man from the Defense Ministry.

However, derogatory remarks about German politicians—even though they are only quotes from foreigners—are not relayed to outsiders. MBB chairman Carl Peter Fichtmueller feels that it would definitely be the best thing if nothing more were now to be written about F-90, to allow the debate to quiet down. There is good reason for this: When Ruehe announced his 'no' to the F-90, it seemed that the bird would be dead as a dodo even before its maiden flight, but the debate this provoked rose to a level now described by Juergen Schrempp, head of MBB's parent organization DASA [German Aerospace] as "much more objective, and widely being conducted with a much greater sense of responsibility."

Schrempp, who has also raised the fundamental question whether "the present system allows politicians to think at all in the long term and reach decisions that are not exclusively election-oriented," now sees good grounds again for looking to the future with restrained optimism. He warmly welcomes the Bonn coalition groups' decision in favor of a version that, although cheaper, will still be a European fighter aircraft: "A clear vote for maintaining our technological coproduction capacity and competitiveness." To lose this, and to lose touch with rapid technical development, acquiring a reputation for unreliability extending even beyond Europe was the German aerospace manager's major fear after the blow struck by Ruehe. Indeed, Malcolm Rifkind, Defense Secretary in London, had already been heard to mutter something disparaging about how seriously future coproduction ventures in Europe could be taken.

The vote of the [Christian Democratic] Union and FDP [Free Democratic Party] members, however, has prompted great activity. By mid-October, the Euro

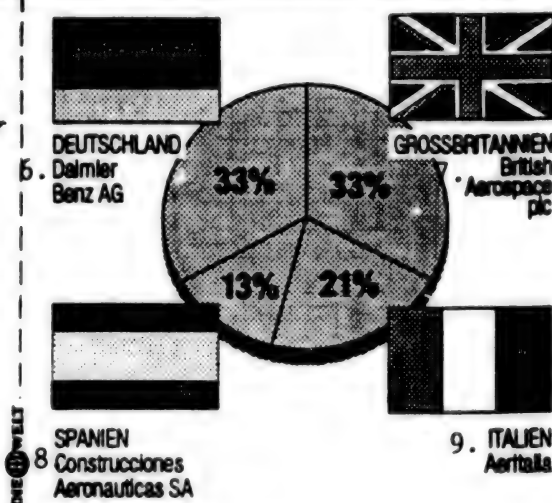
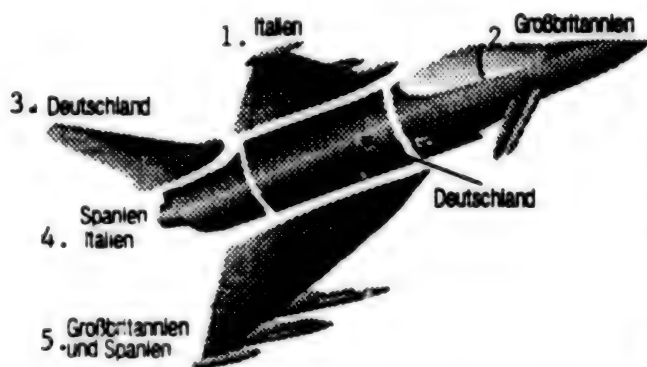
Fighter industry will submit a catalog from which the politicians can pick the fighter aircraft of their choice. Fichtmueller compares this process to that of buying an automobile: "After all, you can buy a car with or without optionals. We shall make suggestions and then ask: where do you want to make savings?" Up to DM6 million per aircraft could be saved on the radar, and even the electronics system could be pared down. "To go ahead is the only thing that matters," says EFA manager Obermeier. Of course, a new airframe could be designed as well, "but that would make it more expensive."

The Jaeger builders do not regard themselves as price boosters, and mention in passing the American F-22, which is said to be costing twice as much. Nor is there much sense in purchasing the MiG 29 when the CIS is already developing a MiG 33. According to Fichtmueller, a fighter aircraft will cost DM64.3 million plus VAT. Another DM24.6 million for VAT and production facilities would have to be added bringing the unit price up to DM88.9 million. The system price with spares, workshop, testing, and training equipment would be around DM118 million.

However, this money would not just vanish without trace into the two fighter units, but would, to a great extent, flow back into the domestic economy. At least 500 companies, most of them medium-sized, were suppliers to the EFA development, and over 10,000 jobs, many of them highly skilled, depended upon it. If the consumption made possible by these wage packets, and the taxes and other duties thus collected, were also calculated, on paper the F-90 would already be cheap to fly. Every DM100 million spent on the F-90 would generate earnings of DM273 million in the national economy, which would in turn result in a flowback of DM62.5 million in taxes and duties. Looked at this way, the finished aircraft would cost scarcely more than DM30 million. Fichtmueller is convinced that a fighter aircraft giving better value for the money than Jaeger is nowhere to be found.

For the time being, however, work on the prototype continues unabated. Its financing is assured and it is scheduled for rollout before the end of this year, but the fact that a rectangular notice with the words "ready for takeoff" in white letters is already hanging at the rear, by the two cartwheel-sized cavities that will later house the engines, irritates the visitor, and this in turn amuses Erwin Obermeier. The aircraft is not, of course, ready for takeoff, but the notice is still justified. "Several of the systems here are in fact ready for takeoff," he says. The hydraulics are one example, the undercarriage another, and now there is also the system directly beneath the tail plane. This is the aircraft's deceleration parachute, whose job it is to ensure a smooth landing.

Teamwork: Wer baut was?

Das Jäger-90-Konsortium
(Jagdflugzeug GmbH)

Teamwork: Who Is Building What. The F-90 Consortium

The F-90 joint project is in a spin. The European partners, Germany, the UK, Italy and Spain—whose financial commitments vary from one country to another—are looking for alternatives.

Key: 1. Italy 2. UK 3. Germany 4. Spain/Italy 5. UK/Spain 6. Germany Daimler Benz AG 7. UK British Aerospace plc 8. Spain Construcciones Aeronauticas SA 9. Italy Aeritalia

ENERGY, ENVIRONMENT

European Microwave Signal Laboratory Analyzes Environmental Changes

92WS0643C Duesseldorf VDI NACHRICHTEN
in German 15 May 92 p 22

[Article by Harald Jung]

[Text] Remote sensing methods are being increasingly used in researching the course of the climate and vegetation of the earth. The "European Microwave Signature Laboratory" (EMSL), which has been opened in the Joint Research Station of Ispra (northern Italy), is making use of the information contained in radar echoes for this purpose.

The huge steel dome which since recently has stood in the center on Lago Maggiore, which was built in 1960 as a nuclear research facility, at first glance could hardly be associated with remote sensing technology. Even after the silent opening of the main portal a person would imagine himself, judging by the foam insulation on the inner walls, to be in a recording studio. Only after persistent questioning of the international team of scientists and technicians has it become clear that this is in fact the new microwave laboratory of the Institute for Remote Sensing (ISRA).

A total of 80 fixed antennas on one half of the domed roof and a row of mobile radar sensors simulate, at any

desired measuring angle, that which takes place via satellites and aircraft under real operational conditions. "The sum of knowledge on the use of radar waves and their interaction with three-dimensional objects in spite of many years of international research is still relatively small," explained EMSL director Alois Siebert. Yet their advantages can be plainly seen. Because of their wavelength (5 cm) the measurements from space can take place independently of the prevailing weather conditions, that is even in darkness or through cloud fields. This feature according to Siebert is particularly useful in the examination of tropical rain forests. Further advantages are the radar waves' partial capacity to penetrate the earth's surface and the fact that their resolving power is independent of the altitude of observation, even if the resolution power turns out to be smaller (30 m X 30 m for each picture element) as compared to conventional remote sensing (photos in the optical and infrared range).

Microwaves are reflected with strong variations according to the physical composition of the expanse of sea, glacier, desert, or vegetational cover which is being examined.

The firm of Siemens played a major part in the construction of the EMSL, by developing the mechanical control mechanism in "made-to-measure" form, to fit the exact positioning of the sensor units. Its high accuracy of measurement (0.05 mm for rotation and 0.5 mm for lateral motion) is made possible by two skid rails,

operated independently from each other and leading over the outer shell of the dome. On the rails the sending and receiving antennas can be aligned to any desired point within the radius of the domed roof. The object which is under examination (for example a pine tree) is placed in a rotating sled, which can be pulled in a straight line, in the middle of the floor of the dome, and in simulation of different diurnal or nocturnal conditions is indirectly illuminated by various floodlights. Even the composition of the air inside the dome can be regulated in accordance with whatever environmental conditions are desired. All measuring operations are visually monitored by two television cameras and compared with the picture recordings. In a further phase of the project a light spectrometer and an infrared camera are to be added for the purpose of heat measurements. All measuring and positioning operations are controlled through a central computer, whose five workstations process the radar signals in real time. Two-dimensional displays as well as three-dimensional tomograms are also planned for the future.

Because of its size and its accuracy and diversity of measurement the Joint Research Station of Ispra is completely unique. A crucial role in its creation was played by the Monitoring Program of the EC Commission, which is planning a series of pilot projects in the fields of agricultural statistics, forestry, and environmental protection. In addition to this there was the successful launch of the earth observation satellite ERS 1.

The Director of the Institute for Remote Sensing, R. Klersy, emphasizes that the recently opened European Microwave Signature Laboratory will be available not only to researchers, but also to commercial users from Western Europe, the USA, and Canada. Potential customers are also the automobile, machine construction, and aerospace industries. In the data processing, which is distributed among five workstations, algorithms will be developed which in the future should make possible automatic evaluation of satellite photographs with uniform reference and calibration standards. New antennas and sensors are also to be developed in Ispra, and the resolving power of radar images is to be improved.

The first step will be the programming of the system with radar images from the Black Forest region, and a comparison of them with corresponding aerial photographs. The knowledge acquired from the model will be gradually transmitted to the TREES Project (Tropical Ecosystem Environment Observation by Satellites), which is scheduled to last from 1991 to 1993. With the help of radar, knowledge about the species and height of timber stands can be gained. The length and intensity of the electromagnetic signal echo make it possible to draw conclusions about the distribution of the biomass and also its state of health.

The first results of the research are expected to be available in the second half of 1992. The goal is an ongoing classification and mapping of the tropical rain forest belt, which will be as complete as possible.

The possible range of application extends still further. Radar makes it possible not only to research methods of soil utilization, but also to draw conclusions about the composition of marine fauna and flora, and to predict crop yields. It can also be used in traffic control, and in robot and communication technology. On the mission of ERS 2, which is planned for 1994, investigations of climate changes and of the hole in the ozone layer are also to be carried out. The Canadian Radarsat, which is supposed to go into orbit in 1995, will also aid in further research of ecosystems through microwaves.

Germany, France Join Efforts to Modernize East European Power Plants

92MI0661 Bonn *TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN* in German
29 Jun 92 p 13

[Text] On 3 June 1992, the German energy supply companies Bayernwerk and Preussen-Elektra and the French company Electricity of France signed an outline agreement in Duesseldorf on energy cooperation in the countries of Eastern Europe.

The three European companies are thus creating a contractual basis for their contacts and activities which have already existed for over six months on many levels and in many spheres. By cooperating in this way, Electricity of France, Bayernwerk, and Preussen-Elektra intend to help the countries of Eastern Europe to set up an ecologically and economically efficient energy supply system. In view of the enormous technical, economic and financial demands resulting from the restructuring of the energy supply in the former Eastern bloc countries, it is appropriate to combine activities that were once separate.

The first joint activities include projects in Hungary, Czechoslovakia, Poland, Russia, the Ukraine, and Byelarus. These include, for example, advice and support for the privatization of supply companies and the creation of efficient company structures. There are also projects involving power stations and the electricity network: for example, the modernization and expansion of the Polish hard coal power station Dolna Odra and the completion and retrofitting with safety equipment of the Mochovce nuclear power station under construction in Slovakia. In addition, preparations will also be continued for connecting up the Eastern European electricity network to the West European combined system at some stage.

German Research on Solar Energy, Hydrogen

92WS0665A Frankfurt/Main *FRANKFURTER ALLGEMEINE* in German 24 Jun 92 p N4

[Article by Brigitte Rothlein: "Solar Energy and Hydrogen; Studies From the Think Tank; Work of the Ludwig Bolkow Foundation"]

[Text] Foundations are an indispensable element of research promotion. To some extent they make possible

scientific work that the government cannot or does not want to take charge of. It is quite unusual for a foundation itself to be engaged in research and to develop studies. Ludwig Bolkow, who will be 80 years old on June 30, created such an institution after retiring from the group of companies he founded. Here it is a question of not just a consulting engineering office, but of a small think tank in which a staff of around 20 is occupied with studies concerning energy, transportation and the environment. The Bonn Ministry for Research and Business, the study committees of the German Bundestag [lower house of parliament], as well as companies, institutes and private individuals, among others, number among the clients of the Ludwig Bolkow Foundation.

The team prepares analyses, plans demonstration and pilot projects, does basic research and develops recommendations. Bolkow furnishes ideas, holds critical talks and also does not shy away from arguments if the supportability of the solutions of competitors or politicians is called in question. For example, there was such a squabble after a study that the foundation developed for the Bonn research ministry in 1988.

Solar Cells Becoming Less Expensive

It was about the cost trend for the generation of electricity from sunlight by means of solar cells (photovoltaic generation). This technology has been known already for years, of course, but the prices were still so high that it was out of the question for generating station applications. Bolkow and his staff studied how prices developed when one assumes efficient manufacturing processes and continuous series-type production. They came to the conclusion that within 5 years the cost of the manufacture of solar generators could be reduced to one fifth or one sixth of today's production cost. However, the precondition was production running to capacity in three-shift operation for 5 work days a week with annual total production of 35 megawatts of peak power.

For the case of two 10-megawatt generating stations being constructed a year, electricity production costs of about 65 to 80 pfennigs per kilowatt-hour are calculated, taking into account the insolation conditions of Central Europe. No one wanted to hear such statements then. Further studies by the foundation on this topic supported the forecasts. The Bundestag ordered a report on the applicability of photovoltaic generation for the climate study committee.

In order not to be caught in the vacuum of pure calculation work, the team is now also taking part in various concrete projects: At the Triesdorf Agricultural Schools in Mittelfranken the contributions that photovoltaic generation can make to the electricity supply in the country are being demonstrated in several examples. Solar electricity is running tools and equipment in the workshop, and the sun is supplying electricity for various tasks besides: for air conditioners in the greenhouses, for controlling air conditioning in the pigsties, for supplying

oxygen in fish ponds, and for the feeding system in cattle breeding. In addition self-generated solar electricity is supplying households.

In developing countries solar-operated minilamps could replace the petroleum lamps used thus far, that have extremely low efficiency. A perfected prototype of the solar lamp with a built-in storage battery already exists, and the first hundred samples will soon be distributed and tried in Third World countries by the German Society for Technical Cooperation. Around 80 to 100 smaller solar electricity units were to have been installed in homes in Berlin and connected to the public electric power system. However, the reunification has strongly delayed this project, for other priorities have been set now. Still there is hope of implementing the project, even if in reduced form, in the years to come. In Munich there will soon be a solar filling station whose modules will be erected at the municipal environmental review building. Construction is to take place as soon as the city is financially able to do so.

Following Bolkow's suggestion, Bayernwerk in Neuenburg vorm Wald in Oberpfalz [the Upper Palatinate] built a solar facility by means of which hydrogen is produced by electrolysis and is being utilized. Solar energy has the major shortcoming that it is available only in phases, and accordingly always has to be combined with a storage medium. The hydrogen technology, which, however, involves substantial energy loss, presents itself as an environmentally considerate solution here. It was revealed in the studies that, besides generation and storage, especially the economical transport of hydrogen causes difficulty.

These problems resulted in an international project that at present is in the phase between concluded preliminary studies and concrete implementation: the "Euro Quebec Hydro-Hydrogen Pilot Project." Behind this project is the consideration that the utilization of electrolytically produced hydrogen should be sped up regardless of the development of photovoltaic generation, so that one does not hinder the progress of the other. Therefore this 100-megawatt pilot project is studying hydrogen that is being produced in Quebec by means of the inexpensively available water power there. The two partners are the Ludwig Bolkow Foundation on the German side and the Hydro-Quebec energy group on the Canadian side.

Fuel From Canada

Studies are being made of the conversion of hydrogen into a transportable form, i.e., either liquid hydrogen or methyl cyclohexane, and of transport by sea from Sept-Îles in Canada to Hamburg, of the necessary storage and reconversion of the product and the use of hydrogen in Hamburg city buses, in an airbus converted for running by means of liquid hydrogen, in unit-type thermal power stations and as an admixture to natural gas.

An advanced ship design, the so-called barge carrier, is to be used for transportation. The ship will transport somewhat more than a thousand tons of liquid hydrogen from

Quebec to north Germany in each transatlantic voyage. It will take five barges having a volume of 3600 cubic meters each. The flatable tanks are moved in the water and can be floated into the transport ship by means of pushing units. The ship accordingly needs no permanent port installation. The containers also serve as storage devices on land.

There is no shortage of ideas. However, the difficulty in implementing them is the long-term basis. The adoption of a basically new technology always requires several decades, experience tells us. And which politician will gladly advocate projects that can no longer be implemented in the current election term? Which company will gladly invest in projects that will yield a profit not before the next century? But it is precisely here that the Ludwig Bolkow Foundation sees its most important mission: to set going now trends without which our industrial society will not be able to survive.

German Automotive Industry To Install CFC-Free Air Conditioning Systems By Late 1993

92MI0669 Bonn DIE WELT in German 7 Aug 92 p 13

[Text] The automobile industry of the Federal Republic will give up using chlorofluorocarbons (CFCs) in air-conditioning units and as insulation foams in refrigerated trucks before a corresponding ordinance of the Federal Minister for the Environment, Protection of Nature and Reactor Safety comes into force on 1 January 1995. According to its own account, the Association of the Automobile Industry eV (VDA), Frankfurt gave this assurance in writing to Klaus Toepfer, Federal Minister of the Environment. CFCs are regarded as ozone destroyers.

Consequently, the German producers will be offering all air-conditioning units for new passenger vehicles in the CFC-free form by autumn 1993 at the latest, when the 1994 models start to be issued. More than half of the models will already be changed over in the autumn of this year when the 1993 models come out. The German producers fit about 700,000 passenger vehicles with air-conditioning units every year; this represents 15 percent of total production.

The sector has also declared that it is prepared to renounce prematurely the use of CFCs for foaming sandwich panels for insulation systems. The use of fully halogenated CFCs in foams for refrigerated trailers and structures is to end one year before the deadline laid down by the law. The changeover to substitutes will be completed during the course of 1993. The premature renunciation of CFCs presupposes that the substitutes are acceptable from a technical, ecological, and health point of view.

FACTORY AUTOMATION, ROBOTICS

Germany: Studies on Industrial Robots for Assembling

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[Article by Uwe Schweigert, scientist at the Fraunhofer Institute for Production Technology and Automation (IPA) in Stuttgart: "Faster and More Flexible: Precision Assembly With Industrial Robots"; first paragraph is MASCHINE & WERKZEUG introduction]

[Text] Several investigations and studies identify the assembly area as one of the focal points of future technological development and rationalization measures in production. Like shorter product service lives, the growing trend toward shorter process times linked with smaller lot sizes imposes increased demands on the flexibility of assembly systems. This development is also taken into account in an increasing use of industrial robots in flexible automated production systems.

Flexible manipulation devices with industrial robots of various designs and a broad palette of modular, programmable axes are available on the market as well as gripping tools and devices for delivery of parts. With these devices alone, it is however possible to automate only a very limited number of assembly tasks. For comprehensive automation of assembly, flexible gripping systems, tools with process integration (e.g., soldering, gluing), tolerance compensation systems, assembly strategies, and components to assure tool function and monitoring of the assembly process are needed. Such systems demand increased use of sensors, which is made possible by the most recent developments in this field.

A great potential for rationalization exists in the precision engineering industry, whose various branches have by far the highest share of assembly costs in the production costs of its products [1 through 4]. Compared with small parts assembly with the most industrial robot applications to date, there are in precision engineering extremely high assembly technology specifications and quality demands which necessitate extreme accuracy of devices. Consequently, automated solutions exist only in the area of mass production (the watch and clock industry, electronics production) with rigid assembly automations and low flexibility. The reasons for the low level of automation in the assembly of short and medium sized series include the following:

- high variety of types and variants,
- small lot sizes,
- technical obstacles to automation,
- shortage of flexible automation components.

High wage costs, due to long assembly times as well as extreme accuracy and quality specifications in assembly, which often exceed those in human production, require

the use of flexible automation assembly systems for precision engineering products for both economic and technical reasons.

The basic prerequisites for flexible automated assembly of precision engineering products are provided through the development of robot technology and new sensors. Initial solutions are already in use in the Far East. However, widespread industrial use demands the development of appropriate assembly processes and new robotics tools.

Analysis of Assembly Tasks

To determine the transferable approaches in the assembly of precision engineering products, a survey was performed by the Fraunhofer Institute for Production Technology and Automation (IPA) and selected assembly tasks have been investigated using workplace analyses. The survey in one of the industrial regions characterized by precision engineering had the objective of narrowing the product spectrum with regard to numbers of pieces, variety of types and variants, lot sizes, tool characteristics, scope of assembly, and obstacles to automation. The evaluation of the survey of 45 companies from seven branches yielded the following results:

- annual numbers of parts of approximately 100,000 through 10 million with extreme values of a few thousand in the area of precision devices and as many as 3 billion in electronics components;
- number of variants per product between 10 and 3,000, apart from electronics components sometimes with a single variant;
- typical lot sizes of approximately 10 to 5,000 items/lot, in the watch and clock industry and manufacture of electronics components sometimes in mass production;
- product volumes from 0.01 to 500 cm³ with the exception of the production of complex precision devices (several m³).

To be able to assess the rationalization potential obtained in the form of production numbers and scopes of assembly, the companies were asked about currently existing obstacles to automation and they were ranked separately according to organizational and technical obstacles. In addition to small lot sizes and the large variety of types and variants, the most significant obstacles to automation are the small size of the tolerance-dependent workpieces as well as small clearances with no bevels. For determination of tolerance compensation demands, it is necessary to perform a study of tolerances and to establish the cumulative tolerances for an assembly system with industrial robots.

In automated assembly, all tolerances which lead to deviations in position must be taken into account. Cumulative tolerances adding all tolerances and deviations are calculated from the workpiece tolerances and the tolerances of the assembly system. The cumulative

tolerances relevant to the assembly of precision technology products are based on measured values, manufacturer data, and empirical values.

The components of the manipulation system (industrial robots or x-y-assembly table) and delivery devices as well as the tolerances of the parts added constitute a significant share in the cumulative tolerances. Position deviations caused by the assembly system depend heavily on the choice and design of devices.

Position deviations at the assembly cross-section level (x-y planes with vertical assembly movements) have crucial significance for the success of the assembly process and the demands on tolerance compensation. The total deviation within the cumulative tolerances up to 0.45 mm compares with the minimal clearance of the respective pairs being joined. In the assembly tasks of precision engineering, it is necessary to also consider environmental influences such as temperature, vibrations, and air currents.

Flexible Assembly Systems in the Precision Engineering Industry

From the analysis of the assembly task and the definition of the "assembly" function, it is possible to derive the partial functions of an assembly system for precision engineered products and to allocate them to subsystems according to the definition of a programmable assembly system. The subsystems are supplemented by subsystems for performance of ancillary functions (control systems, energy and data communications systems) and subsystems for process materials (e.g., application of adhesive). The fundamental demands on a combined system for precision engineered products apply equally to all subsystems:

- product flexibility: assembly of varied product types and variants without manual retooling,
- monitoring of assembly processes and quality inspections,
- completion from modular subsystems/components,
- reduced share of task and type specific tools,
- high accuracy requirements.

The small size of the parts added found in the analysis to be the cross-sectional problem along with the small clearances imposes high demands on the gripping system. These are:

- highly accurate centering of the workpieces without center shifting with variable diameters,
- high mechanical rigidity and freedom from play,
- no hysteresis and no stick-slip effect,
- no error functions with tolerance-dependent workpieces,
- secure holding of the workpiece during transport and joining process with the least possible gripping forces/no slippage,
- highly accurately adjustable/programmable gripping forces,
- no damage to workpieces from grippers,

- gripper jaws adjustable/exchangeable for different workpiece diameters and gripping surface geometries,
- the smallest possible gripper jaw geometry and gripper opening paths for tight gripping spaces,
- simple, space-saving design/compactness,
- integration of sensorized process monitoring,
- short gripper opening and closing times,
- interfaces to tool changing devices,
- high reliability and availability.

In addition to the essential high accuracy and rigidity of the gripper mechanism and gripper jaws, programmable gripper systems with high-resolution of gripping force and the gripper closing path are required for sensitive assembly parts.

To permit compensation for workpiece and assembly system tolerances, new processes for tolerance compensation must be developed to meet the extreme demands for the accuracy and resolution of the tolerance compensation. This leads, in addition to the demands on tolerance compensation systems, to demands on sensor systems to monitor tolerance compensation and to perform essential measurement tasks. Chief among these are highly accurate measurement of

- workpiece position and position deviations,
- angular deviations of the assembly axis,
- assembly force and moment,
- spring deflection paths of tool elasticities.

State of the Art

Since the beginning of the 1970s, many investigations of assembly methods and developments of assembly mechanisms have been conducted. The focus of the investigations and developmental research was tolerance compensation methods for conventional bolt and hole problems. The systems known to date operate with three different fundamental principles:

- measurement of position deviation and precision positioning,
- application of search strategies,
- elasticity of the assembly mechanism.

For precision assembly tasks, the known tolerance compensation systems [5, 6] have only limited suitability, because only assembly parts with diameters greater than 2.0 mm have been investigated and it has only been possible to achieve resolutions from 0.01 mm with pairs of items to be assembled with bevels and 0.02 mm without bevels. As yet, no tolerance compensation systems exist for assembly clearances less than 0.01 mm.

Development of Tolerance Compensation Processes

In addition to compensation for position errors in the x-y plane, tolerance compensation in assembly with vertical assembly movements also includes compensation for tip errors and assembly axes of the workpieces. These errors can be compensated for during insertion of the part added and the base part into each other by

means of passive assembly aids (RCC = remote center compliance). However, the "search function" of the tolerance compensation system is of utmost importance to the control of precision assembly tasks. Consequently, a priority must be placed on investigating processes which permit compensation for position errors in the x-y plane.

The processes developed for tolerance compensation may be classified as regulated, controlled, or uncontrolled processes. Regulated processes process sensor data for the position deviation of the part added and the base part and then perform precise positioning. Crucial to the applicability of these processes to precision assembly tasks are the resolution of the sensors and precision positioning movements. Controlled processes compensate for position errors of the part added and the base part through specific search and position motions. The sensor outlay required is limited to recognition of the target position in order to halt the search process. Uncontrolled process use the reactive forces during the action of an assembly force to perform tolerance compensation through appropriate elasticity of the assembly system. For this no sensors are needed. The applicability of uncontrolled processes is however limited to workpieces with bevels or requires mechanical assembly aids.

Furthermore, tolerance compensation processes are classified as 1st, 2nd, and 3rd order depending on whether the tolerance compensation occurs via the movements of a workpiece (1st order), a tool (2nd order), or a manipulation device (3rd order). Compensation movements of the 1st order through direct movements of the workpiece in the force field (e.g., magnetic field) or in the flow field (e.g., suction and blowing) can only be performed with difficulty with current technology. Compensation movements of the 3rd order require manipulation devices with very high resolution, which can only be obtained with great technical outlays and associated costs.

For sensitive assembly parts, tolerance compensation can only be performed with certainty with a regulated process with contact-free measurement of position deviation and subsequent precision positioning. Possible positioning errors due to production tolerances of the parts added are not included in this and can only be compensated for through prior straightening of the part added [7].

Generally, regulated processes require a large technical outlay for sensors and precision positioning and, because of the sensor data processing in mostly multiple iteration loops, require a clocktime which is not insignificant. Consequently, of the processes investigated, search strategies with workpieces vibrating relative to each other under the effect of an assembly force are best suited for the demands imposed on the tolerance compensation system.

Vibration-Assisted Tolerance Compensation

In vibration-assisted assembly processes, the oscillation pulses of a tool are transferred to a workpiece, and a

specific area in the assembly plane—the tolerance compensation field—is searched until the joining force initiates the connection phase of the assembly process upon contact of the added part and the hole in the base part. During the connection phase, tilting of the added part and the base part can be prevented by continuing the vibration. Due to the smaller dimensions and weights of the part added compared to the base part, during tolerance compensation it is recommended to have the added part vibrate relative to the stationary base part. The more favorable dynamic behavior due to the lower weights to be moved permits greater amplitude of the vibrations and consequently

- larger tolerance compensation fields,
- shorter assembly process times,
- higher resolutions, and
- increased probability of joining.

The principles of vibration-assisted search movements of the part added differ in type and direction of the oscillation pulse as well as the transmission of the vibration from the tool to the part being added. Depending on the design, there are vibration sweeps of the added part in the cross-sectional plane of the joint. The vibration sweeps of the center of the part added can be represented as trajectories of the search motion in the tolerance compensation field.

The surface of the tolerance compensation field TCF brushed over determines the size of the position deviations which can be compensated; the maximum distance between trajectories a_{TM} , the least possible clearance of the parts to be joined. The maximum search time and the resultant assembly process time, like the probability of joining, depends on the interplay of several search parameters:

- type of search movement,
- amplitude of the vibration frequency,
- overlapping of several vibrations, and
- regularity of the vibration sweep in the tolerance compensation field.

Spiral search movements are of course technically simple and can be implemented without great expense and enable compensation of large position errors, but permit only low vibration frequencies and large distances between trajectories a_T . The resolution attainable, maximum search time, and probability of joining do not satisfy the demands of precision assembly.

Tolerance compensation using irregular vibrations has already been successfully tested for the assembly of bent parts; however, the results are only partially transferable to the conditions of precision engineering and precision assembly. In particular, the assembly process time and the probability of joining are indefinite due to the irregular, haphazard search movements; and a distance between trajectories cannot be preset. Consequently, guaranteed compensation of clearances in the micron range is not possible.

Using two orthogonal linear vibrations with a slight phase shift or different frequencies, a vibration sweep which systematically searches the tolerance compensation field is created in the cross-sectional plane of the joint. The trajectories of the search movements form so-called Lissajous figures, which cover the entire tolerance compensation field like a grid. The amplitudes x and y of the linear vibrations determine the position deviations which can be compensated; the frequency ratio f_x/f_y determines the maximum distance between trajectories and, consequently, the least possible clearance of the parts to be joined. This and the absolute amplitude of the frequencies f_x and f_y yields the maximum assembly process time.

Theoretically, with the process, infinitely small clearances can be obtained, if virtually equal frequencies are selected. However, in practice, resolutions less than 1 micron can be obtained only with difficulty because, due to the differing masses which must be moved in the x and y direction and the attenuations, the elasticity constants, and the vibration transfer behavior which cannot be exactly determined in advance, the tolerance compensation system always has a slight difference in the frequencies in the x and y direction.

Prototypical Robot Tool

To test the processes elaborated theoretically for vibration-assisted tolerance compensation and to determine parameters for use, a prototypical test tool was developed and produced. The tool consists of four plane-parallel plates which are disposed one over another and which can be moved in different directions relative to each other.

The top plate connects the tolerance compensation module with the bottom of the standard gripper exchange system with which the tool can be flange-mounted on the wrist of the industrial robot. The second plate can be moved in the x -direction relative to the top plate and the third in the y -direction relative to the second against leaf springs. Two compressed air vibrators drive the vibration movements of the second and third plates perpendicular to each other and permit frequencies up to 150 Hz respectively. Through the use of linear magnetic drives, piezotranslators, or electric motors with eccentric disks, even significantly higher frequencies may be obtained; however, the creation of a functional model requires significantly greater expense.

Even with the preferred solution with compressed air vibrators, it is possible to preselect the frequencies by the pressure applied to a manometer and the amplitudes using the volume flow of two chokes. The bottom plate of the tool has a parallel-jawed gripper with a gripper jaw changing system and can give way in the joining direction against the third plate through bent leaf springs applied on all sides and tilt around the assembly axis. Thus the spring deflection of the tool during the search phase can be monitored by a built-in proximity switch and at the same time compensation of the tipping of the

part added relative to the base part can be made possible during the contact and connection phase of the assembly process.

The evolution of the vibration-assisted assembly process is characterized by alternating assembly motions of the industrial robot and search motions of the vibration tool. The robot positions the part to be added above the joining position of the base part and travels linearly in the assembly direction (z-axis) until the sensor responds to the spring deflection of the tool. This triggers the search movement by the vibration tool and continues it until the part added has found the hole in the base part and the spring deflection sensor switches off. Then the robot continues the assembly motion until the assembly process is completed. The assembly process can be interrupted again by a tilting of the part added in the hole. This is detected by the spring deflection sensor and compensated for by renewed vibration movements.

Testing

To test the process developed and the tool produced, a series of tests were performed in which cylindrical pins without bevels were to be assembled into holes also without bevels in a test plate with a clearance of less than 0.01 mm. Pins with diameters between 1.0 mm and 5.0 mm were used and tests were performed with position deviations from 0.1 mm to 0.6 mm. In all tests the pressure set with the manometer and the choke settings of the tool were varied and suitable frequencies and amplitudes of the vibration motions were measured empirically. High-speed photographs confirmed the findings previously derived theoretically. The process developed and the tolerance compensation system permitted assembly tasks with a clearance of less than 0.01 mm and position deviations of $e = 0.5$ mm in a search time of less than 0.3 seconds with a joining probability of virtually 100 percent.

The practical test of the tool was performed using the example of the assembly of a valve piston in a valve housing with a permissible clearance of 4 to 8 microns. The valve piston has four control edges without bevels, which are inserted in sequence into the housing during the assembly process. With the fourth control edge, four assembly points with a respective clearance of 4 to 8 microns have to be managed simultaneously. This so-called multipoint contact brings added difficulty to the assembly task. Because the piston also tends to tilt constantly because of the very small clearance, manual assembly is possible only with extreme sensitivity and is very time-consuming. In a series of tests with a Scara robot and the test tool which was developed, it was possible to assemble the valve piston with an assembly time of less than 3.0 seconds and a joining probability of more than 98 percent.

Outlook

The vibration-assisted tolerance compensation system developed is suitable for compensation of large position

errors with clearances in the micron range for workpieces without bevels. The selection of frequencies and amplitudes permits simple and quick adaptation of the tool to different assembly tasks. In a next step, regulated processes must be developed for tolerance compensation for very sensitive workpieces, which enable tolerance compensation using sensor determination of position deviation and subsequent precision positioning without making contact with the workpiece.

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Switzerland: Status, Prospects of Machinebuilding Industry

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[Unattributed article: "Swiss Machinebuilding Industry at the Crossroads—No Alternative to the EC: In Principle Yes"; first paragraph is MASCHINE & WERKZEUG introduction]

[Text] Switzerland must pack its bags for a one-way trip. It is now free for adoption by the European Community. It can only be an act of self-preservation for it to change its spots and dress itself in economic egoism. Switzerland has its foot in the door for union with the EC with the EFTA [European Free Trade Association], in the meanwhile the EES [European Economic Space] will be a station. Its machine tool industry, far from mediocre, needs weatherproofing against hard times. In Europe, time is running out for the sector—Japan is already on the move.

On 5 May when the Duesseldorf Fairgrounds opens its gates for "Metav 92", two countries which otherwise occupy top positions do not head the list of exhibitors in this "Marketplace for Metal Processing": Neither the leader in worldwide export of machine tools, the Federal Republic of Germany, nor the largest machine tool producer in the world, Japan.

Instead, the chief contingent of exhibitors will be a major European producer of machine tools with 118 companies represented directly and indirectly: Switzerland. Italy follows with 111 exhibitors and Japan is next but far behind (55 exhibitors).

Because of their small domestic market, the Swiss are dependent on the flourishing of their export trade. The Swiss machinebuilding and metal industry brings in more than 60 percent of their export proceeds (in some areas even more than 90 percent). In addition to actual machinebuilding, this includes plant construction, the electrical industry, vehicle manufacture, and producers of instruments and apparatuses of extremely varied types as well as the electronics sector, which has now become increasingly important to virtually all sectors.

Mouthpiece for the Industry

The Union of Swiss Machinebuilding Industrials (VSM) thus speaks to a large extent for the capital expenditures industry in general. More than 500 member companies, which together employ roughly 200,000 workers, are united in the VSM. This corresponds to approximately two-thirds of all workers employed in this industrial sector. Thus the VSM is one of the largest industrial organizations in the country and representative of the entire branch.

From the standpoint of company size, the VSM is a reflection of the structure of small and medium sized industry in the Swiss economy: 19 percent of the member companies employ fewer than 50 workers, 61 percent between 50 and 499, and 20 percent 500 or more. The average work force of VSM member companies is 400. In terms of products and markets, and also in terms of company size, the Swiss machinebuilding industry is very heterogeneous.

Precision engineering has characterized the reputation of Swiss products in the markets of the world. The Alpine Republic is constantly concerned about this reputation. In the 1970's its watch and clock industry endured a debacle which should not be repeated. The ETH [Swiss Technical University] of Zurich has recently documented in an investigation that the competitiveness of the Swiss export industry was never seriously in jeopardy. One contributing factor in this—according to national adviser and professor of sociology in Geneva, Jean Ziegler—is the fact that "thanks to banking secrecy, numbered accounts, and free exchange operations, the Swiss financial market is a giant ... playground for the world's money jugglers."

This certainly compensates for the by no means optimal local factors in the Alpine Republic: High wage levels, significant capital costs, and considerable inflation. Stability might have required participation in the European Monetary System (EMS), but the Swiss are for the time being not interested.

Strong in One Sector

In fact the Swiss machinebuilding industry holds the worldwide lead position in various product areas. The machine tools group with its product catalog includes all the modern production processes. Swiss machine tools are used in demanding mold making (jig boring machines and grinders, erosion machines) as well as for those mass production processes which require high, consistent quality precision (grinding, sharpening, turning, gear cutting, non-cutting shaping, precision stamping, etc.). The extent to which the Swiss machinebuilding industry is concentrated on machine tools is reflected in the number 1.02 percent: Its share of total industrial production in 1990. By way of comparison, this figure is only 0.55 percent in the Federal Republic of Germany, 0.33 percent in Italy, 0.37 percent in Japan, and 0.06 percent in the USA.

In 1991 in Switzerland, 13,000 workers in 115 companies produced machine tools with a value of 3,643 million Swiss francs [Sfr]. This included Sfr2,790 million for cutting units and Sfr844 million for forming units.

The export figures are proof of its competitiveness. In 15 important countries, Switzerland has sold machine tools in recent years as follows: 1988: 22,152 units at a value of 874 million German marks [DM]; 1989: 36,827 units at a value of DM1,020 million; 1990: 90,336 units at a value of DM1,163 million. Domestic consumption (defined as the difference between production and exports, plus imports) was DM604 million in 1988; DM1,600 million in 1989; DM1,910 million in 1990; DM1,620 million in 1991.

Of the total exports of the sector in 1989 valued at Sfr37.2 billion, Sfr21.7 billion (58.3 percent) went to the 12 countries of the EC. In contrast, machine imports into Switzerland from the EC amounted to approximately Sfr15 billion, which represented 36 percent of all imports (Sfr41.1 billion).

Always Up and Down

With capacity utilization of approximately 90 percent, growing orders from abroad (up 18.6 percent in 1989 compared to the previous year), and a 7.7 month supply of orders in hand (6.9 at the end of 1988), the sector entered the 1990's "at full power."

From an economically and competitively dominant position, the more intense competition after the introduction of the single EC internal market should catch on confidently. Because the EC market, with a share of approximately 60 percent, is the largest market for the Swiss machinebuilding and metal industry.

However, the annual results of the Swiss machinebuilding and metal industry have never been completely without fluctuations in recent years. Actually in 1990, the beginning of the year was brilliant, then domestic orders melted by 12.7 percent and orders in hand dropped from 7.2 months at the end of 1989 to 6.1 at the end of 1990. There was still growth of exports in the EC by 10.2 percent, in EFTA countries by 8 percent, to the USA by 8 percent, to Latin America by 2 percent, to Asia by 12 percent, and to Africa by 3 percent.

In all economic regions of the world, there was a decline in the export of Swiss machine tools from 1990 to 1991. In Europe it totaled -12.4 percent (including -7.9 percent in the EC and -29.6 percent in the rest of Europe), -3.7 percent in Asia (including -11.1 percent in Japan) and -11.9 percent in the USA.

All years prior to that still demonstrated growth rates in Swiss exports, which, for example, in the EC last stood at 22.4 percent, at 16.5 percent for Japan, and 10 percent for the USA. The economic slump was unexpectedly fast and massive in all machine tool markets, and thus for Switzerland as well.

Customer and Competitor

When the year 1991 began, the year 1990 for VSM had gone "well as a whole." However, this statement "certainly takes into account" the fact that the 1990 inflation rate in Switzerland had climbed to 6.4 percent. The Swiss franc suffered from overvaluation and was also exposed to large rate fluctuations. Consequently, there were losses in market shares abroad. However, in 1991 the Swiss managed to curb the retrogression in the economy, although there were isolated plant closures. Unemployment also rose to 1.1 percent—still atypical for Europe, but a maximum since 1985 in the absolute number of 40,000 unemployed.

When the cost situation of companies in the FRG was aggravated for social and labor policy reasons (introduction of workweeks between 35 and 38 hours), the Swiss machinebuilding and metal industry came into a more favorable competitive situation.

In the past year of 1991, cutting machine tools with a value of Sfr2,419 million and shaping machine tools with a value of Sfr731 million went into exports. In all this was a share of 86.6 percent of domestic production. Machine tool imports in 1991 were on the order of Sfr884 million and thus covered 64.8 percent of domestic consumption.

With Sfr1,042 million in 1991, the FRG was by far the largest purchaser of Swiss machine tools. France was far behind with only Sfr288 million, ahead of the USA with Sfr279 million, Italy with Sfr229 million, Japan with Sfr176 million, and Great Britain with Sfr136 million.

The FRG was also the leader of the pack in suppliers of machine tools to Switzerland: With Sfr438 million, ahead of Italy with Sfr124 million, Japan with Sfr91

million, France with Sfr79 million, Great Britain with Sfr32 million, and the USA with Sfr17 million.

Machine Champions Today

Because, with a contribution of approximately 45 percent of the total exports of goods from Switzerland, machinebuilding is the country's largest export sector and the largest employer with almost one-half of all workers in the industry, according to VSM President Wolfgang Marti, one thing is certain: "Without a flourishing export industry Switzerland would still be a developing country as it was a hundred years ago when tens of thousands were unemployed and had to emigrate to all parts of the world."

In the 19th Century when old industries disappeared in Switzerland and new, larger ones emerged, there were major conflicts between the industrial workers of the period and the companies. They were not directed against long working hours (it was not until the first federal factory law of 1877 that the maximum work week was set at 65 hours) and low wages, but simply against modern technology, against the machines which threatened to replace working hands.

The most vivid demonstration of this came on "Uster Day" in 1830. That day a ban on mechanical looms was demanded by the people. Two years later when nothing had happened under the law, a spinning mill was set on fire, in Uster again and on an "Uster Day," as a signal of taking matters into one's own hands. "They promised us to get rid of the machines but did not keep this promise," said the arsonist. "We owe it to ourselves and to our children to destroy the machines because they are stealing our income." One hundred sixty years later: Industry long ago took the creative hands from once dominant agriculture (whereas around 1800, 65 percent of the population were farmers, the figure is now only 11 percent), and earnings are so good with the despised machines that "salary expenditures almost exceed what the companies can bear," according to GF administrative board member Dr. Hannes Goetz.

Going It Alone is a Lost Cause

Switzerland is a member of the EFTA. When talks began in June 1990 between Switzerland and the EC about a common European Economic Space [EES], many Swiss sensed an opportunity. However, in 1990 heated discussions developed about a stronger connection with Europe between the supporters of a politically and economically independent position for Switzerland and the advocates of a policy linked to the EC.

In light of their problems Swiss exporters, led by representatives of the machinebuilding industry, are considering closer dependence on the EC since it remains its best customer. Approximately two-thirds of Swiss machinebuilders were no longer making any real profit in the first half of 1990. An investment boom in Western Europe as a "fitness program" for the introduction of the EC internal market would be the guarantee of having full order books

again. Then, a rethinking process set in rapidly, touched off by the official celebration of the 700th anniversary of the Swiss Federation in June 1991. The memory of the mutual assistance pact concluded in the summer of 791 between the cantons of Uri, Schwyz, and Unterwalden gave impetus to the progressive strategists.

VSM president Marti expresses what is expected from Switzerland's participation in the EES and even in the EC as follows: "It is obvious that the extremely export-oriented Switzerland would inevitably have to fall behind without discrimination-free access to the Western European Economic Space." In another place, Marti thinks it would be "truly grotesque if in the era of the emergence of Europe, the so-called option of Switzerland going it alone were taken."

Precisely for the Swiss machinebuilding industry, a refusal of the EES or the EC could not rule out a set of technological discriminatory actions. If, however, within the EC technical obstacles are also constructed, then as a member Switzerland would be protected by the mutual recognition of standards.

Brussels is in a Hurry

The fact that within the framework of an EES treaty in record time some 60 Swiss laws had to be changed is for many Swiss an uncomfortable image where they would like radical changes of all kinds to move more slowly.

In the country the enormous amount of time needed for results of a political decisionmaking system with direct Swiss democracy does not match Brussels' tempo. Nevertheless, Switzerland can no longer avoid a political anchoring with the EC, even if it means the loss of national jurisdictions.

In a referendum at the end of 1992, the citizens of the country must decide whether they want to step beyond the EES into full membership in the EC. This decision exposes the country to a really crucial test. Its beloved referenda would then only be possible in those areas which the EC permits them.

The economic integration into a greater European community is already anticipated in many ways. But to move from national sovereignty to European sovereignty requires a response to the difficult question: How much of their own sovereignty must be surrendered under these circumstances? In terms of the entire economy, Swiss industry has always valued free economic development potentials.

Frightening EC

The colossus of the European Community seems strange and threatening to many Swiss. The current dictatorship in Brussels does not match their expectations. In contrast to their country, the Swiss see the EC as absolutely undemocratic. They feel that Brussels' interest is exclusively in free traffic in goods, capital, services, and workers.

Nevertheless, 57 percent of French speakers and 33 percent of German speakers want to be involved in the integration adventure with the EC. Thus, in June 1991 the Swiss Council of Ministers solemnly declared its intention to join the future European Economic Space between the EC and the EFTA countries.

The fear of economic policy makers is deep-seated about Brussels' charges that the Swiss only wanted a free ride, to profit from the large market, but not to sacrifice any independence themselves.

Representatives of the machinebuilding industry see the benefit primarily in further intensifying the treaty network with the EC and its members. According to Jean Ziegler, "Europe must save Helvetia. The sooner, the more radical the integration, the better."

For the Swiss machinebuilding and metal industry beneficial impulses could also come from the Eastern European area and the volume of investment opening up there could initiate follow-up orders through Germany as well.

Danger From the Outside

The coalescence of the machine tool industry in Europe is increasingly intensive and further stimulated by the Common Market. The Swiss machinebuilding industry has a dominant position internationally, its economic engine is foreign trade, and its major products are (in addition to chemicals) first quality machines. After a recessive economic situation since 1983, 1992 is expected to bring a slight economic recovery.

That will be necessary since the common internal market increases the prospects for success of the Japanese among others. They have arrived in Europe with their campaign for conquest of the machine tool industry. The competitiveness of Swiss manufacturers must be demonstrated in this crisis. For the Swiss who were once strong in exports to the East, the collapse of the eastern markets is an additional difficulty. The Japanese are countering the structural problems, particularly in the large European manufactures, with adaptable structures and strong financial reserves. Their sales returns in the double digit range during "fatter" years afford them broader price latitude and significant financial staying power.

In Europe, structural problems and management errors in the past were masked by the booming economy; adaptability lacked the necessary urgency. Plant closures in Switzerland occurred because the financial reserves to weather a long fight for existence were lacking.

Nothing Without Fanuc

The Japanese campaign to conquer Europe is in full swing and is advancing from three sides at the same time: Through imports from Japan (the Japanese delivered machine tools to Switzerland with a value of DM15.2 million in 1988, DM17.8 million in 1989, and

DM22.1 million in 1990), through imports from Japanese subsidiary plants in the USA, and through production sites of the individual manufacturers in Europe.

The Swiss machine tool industry is in the same situation as the industry in Europe, suffering from increasing loss of competency in key technologies and components. The semiconductor industry in memory chips is firmly in Japanese hands, and that of microprocessors in American hands. "The European machine tool producer who wants to be successful with standard machines in the United States or in Southeast Asia can hardly do without Fanuc anymore," is the opinion of the UMB Unternehmensberatung Munich GmbH.

Because of the fact that in the new German federal states, the machine tool capacities are not internationally competitive from a market-economy point of view, the Swiss industry anticipates only a slight impetus from East Germany. Instead, it is focused on its internal market.

Transportation Stimulant

Here according to information from VSM, an increase in forces of domestic production in the second half of 1990 was caused by large orders from the transportation and energy sector. Things are happening in this sector in Switzerland: In mid-1993 construction of new railroad tunnels under Saint Gotthard (length 49.3 km) and Loetschberg (length 28 km) is supposed to begin. However, the so-called Neat (New Railroad Transversals) valued at Sfr24-billion were still contested as late as mid-1991.

Another imposing transportation project is based on truck traffic through Switzerland. At the beginning of 1991, the EC Commission demanded the opening of a transit corridor for trucks up to 40 metric tons and made the integration of the EFTA into the European Economic Space, among other things, dependent on it.

As a condition for joining the EC, on the other side in March 1991 one of the Swiss political parties required the Swiss to establish the limit for truck traffic through the Alps at 28 metric tons, among other things. This dispute is still smoldering.

Such a fiscal policy of the public budget with domestic demands could very well counteract a slack recovery in the Swiss machinebuilding industry. According to the Basel Team for Economic Research (BAK) this is anti-cyclic and completely desirable.

Switzerland took the offensive when in 1991 it was a partner country in the Hannover Fair. The fact that in 1991 the 700-year existence of the Swiss Republic was also celebrated was the breakthrough of a new realization: For the long or the short term, Switzerland can only survive jointly in the European household. If it keeps to itself, it will perish.

LASERS, SENSORS, OPTICS

Germany: Firm Develops Range of Sensors for Microtechnology

92WS0652A Duesseldorf WIRTSCHAFTSWOCHE
in German 22 May 92 p 74

[Article by Wolfgang Kempkens: "Precision Destruction"]

[Text]

Sensors: Precision Work With Laser Support

HL Planartechnik of Dortmund Causes Excitement with Tiny Sensors. Range Constantly Being Expanded.

They are masters of the art of coating any kind of substrate with delicate layers of virtually any material. Now, the employees of HL Planartechnik GmbH of Dortmund also can destroy them with just as much precision. A laser system from Electronic Scientific Industry (ESI) from Portland, Oregon, USA, provides the destructive act. The system costs a total of 1.2 million marks. The device, which may be used by third parties, was financed by the Center for Microstructure Technology, also located in Dortmund.

Joachim Winterfeldt operates the system. He also writes the software for each new application guiding the beam accurately to its target. In spite of the destructive nature of his job, Winterfeldt is a highly respected colleague. Destruction, as he practices it, increases the value of the products.

Boxes full of silicon wafers are delivered. Extremely precise structures are located on the surface of these wafers. The metal tracks that twist and turn a number of times and that are to function as sensors are only a few thousandths of a millimeter wide. So that they operate accurately, they must maintain specific electrical values exactly. For example, they must have a resistance deviating from the desired value by a maximum of 0.2 per thousand. The laser does the fine tuning. It removes metal until the target has been reached. To do this, the system needs a total of four seconds per sensor, including the electrical measurements and subsequent inspection. Johannes Herrnsdorf and Hans-Joachim Lilienhof are the two managing directors of Planartechnik. This speed is just right for them. Business is just starting to take off, 3 years after founding the company. "Until now," according to Herrnsdorf, "we were glad to get contracts with a five-digit total. Now, more and more six-digit sums are involved." This has the revenue increasing rapidly. Following 670,000 marks in the last year, the 23 employees will generate revenue of considerably more than two million marks in 1992.

To date, the most important revenue generator among the products is a magneto-resistive sensor. By the end of this year, a total of 500,000 units will be delivered. Of these, 80 percent were produced this year. Each individual sensor will be treated by the ESI laser in the

future. Before, sensors having values not exactly on target at the outset had to be rejected. "Reworking increases the yield from 40 per cent before to more than 90 per cent," says Lilienhof happily.

He and his comrades-in-arms need the success. A complete microelectronic fabrication plant in the Dortmund Technology Park cost a total of seven million marks. Numerous high-tech companies such as Cap debis and Tandem located at the park. Instead of chips, this fabrication plant is exclusively producing sensors using thin-film technology. The actual sensors are located on small chips of silicon, glass or ceramic.

The magneto-resistive sensor, for example, is made of an iron-cobalt-nickel alloy. This alloy changes its electrical resistance when moving in a magnetic field. The sensor is suited to detecting defective bulbs in an automobile and for use in non-wearing joysticks for controlling industrial processes. At this time, large quantities of this sensor are used to manufacture electronically displaying spirit levels.

More elegant, but considerably more expensive, are tilt sensors. These have been on the market for a few weeks. These sensors contain a measuring chamber filled with an alcohol-based liquid. The electrical resistance of this liquid changes when the sensor is tilted and the liquid collects at the lower point. It is suitable, for example, for checking the exact position of workpieces before starting machining.

A conductivity sensor for washing machines is to save expensive water. This sensor was just developed. It interrupts the rinsing cycle when the detergent residue has dropped below a certain level.

The more sensors the people from Dortmund develop and produce, the more secure not only their own jobs but also those of Mikroelektronik Neuhaus GmbH in Thuringen. This is where the wafers structured in Dortmund are sawn apart, wired and bonded in plastic housings. This helps to better utilize the very advanced system procured shortly before the currency union. It also helps rescue the last 200, at one time, of the 2500 jobs.

Stuttgart Institute Develops ASICs for Industry

92WS0652B Duesseldorf WIRTSCHAFTSWOCHE
in German 22 May 92 p 76

[Article by Ks: "ASICs: Special Sale"]

[Text] Erwin Sick GmbH from Waldkirch in Baden-Wuerttemberg improved an optical proximity switch using a special chip. This was an ASIC specially designed for this task. Novotron from Ludwigsburg uses a different ASIC in a control unit for three-phase motors. These motors move robots. Ergoline from Bitz in Wurttemberg is installing a special chip into an evaluation unit for ergometers. These devices measure the physical loading on humans. The products became cheaper and simultaneously the production costs dropped. The three

medium-sized companies profited from an array of services offered by the Institute for Microelectronics of Stuttgart. This is a public-law institute that has developed into a commercial ASIC developer and fabricator. While established vendors for development and initial chip samples easily charge six-digit sums, the people from Stuttgart are satisfied with about 10,000 marks. In spite of this amount, they make a profit because they use an inexpensive method. This method is electron beam lithography. Sharply focused electrons mill the required structures into the silicon surface using one-micrometer technology. One micrometer is one-thousandth of a millimeter. The photochemical processes usually used elsewhere are considerably more expensive.

One more trick reduces the price of production in Stuttgart. Silicon wafers are used as the raw material. A large-scale industrial process furnished these wafers to a large extent with electronic components such as transistors. Siemens supplied these wafers. The electron beam tailors the standard chips to the customer's wishes. It takes a total of 60 minutes to describe a wafer thanks to a system from the Japanese manufacturer Hitachi. This system is ten times faster than competing products. Once the wafer has been described, it can be used to fabricate hundreds or even thousands of chips. "We offer our services primarily to small and medium-sized companies that cannot afford ASIC development and production from established fabricators," says Professor Bernd Hoflinger, director of the Institute.

MICROELECTRONICS

Seven European GaAs Manufacturers Cooperate in EUREKA Project

92BR0589 Paris ELECTRONIQUE INTERNATIONALE
HEBDO in French 18 Jun 92 p 10

[Article signed F.G.: "European Suppliers of GaAs Circuits Join Forces"]

[Text] The seven leading European manufacturers of gallium arsenide [GaAs] circuits have just set up a consortium to combat foreign pressure.

The JESSI [Joint European Submicron Silicon Initiative] program for research into silicon microelectronics is winning converts in the world of gallium arsenide. The seven leading European suppliers of GaAs integrated circuits, led by GEC Marconi, have indeed just created a consortium aimed at standardizing their design and production environments for GaAs circuits in order to put up greater resistance to pressure from American and Japanese manufacturers.

The consortium, whose goals in the area of gallium arsenide are similar to those of JESSI in the area of silicon, has just received the EUREKA label for a project named Euro-GaAs. Unlike ESPRIT [European Strategic

Program for R&D in Information Technologies]-type projects, the aim of Euro-GaAs is not to develop new technologies. The project focuses on CAD [computer-aided design], casings, materials, and various manufacturing technologies. Apart from GEC Marconi, Euro-GaAs includes Thomson Composants Microondes (TCM), Philips Limeil, the Fraunhofer Institute in Freiburg (Germany), Daimler-Benz, Aeritalia & Selenia, and Alcatel Telettra. Together, the participants put up the \$3.2 million required to finance the 12-month launch phase aimed at identifying the flaws in Europe's gallium arsenide industry. In the longer term it will prove possible to launch projects involving other companies. These projects will be financed by the participants, the governments of their country of origin, and the European Community. A number of these projects could get off the ground toward the end of this year. GEC Marconi has calculated that around £15 to 20 million (about 150 to 200 million French francs) are required each year to enable Euro-GaAs to operate smoothly.

Wide Range of Components and Technologies

The seven European companies cover a wide range of technologies and components: discrete and power semiconductors, digital integrated circuits, standard analog hyperfrequency integrated circuits, and application-specific integrated circuits. TCM, which has agreements with Vitesse for digital and Anadigics for hyperfrequency and analog circuits, is getting ready to start up a production unit for 100 mm diameter wafers in Saint-Egreve, near Grenoble. The consortium leader, GEC Marconi, has just invested £15 million to upgrade its production unit in Caswell, Great Britain. The unit will now be able to produce several thousand 75-mm-diameter wafers per year beginning next July.

Spain: Joint Public-Private Electronics Research Center Created

92BR0591 Paris *ELECTRONIQUE INTERNATIONALE*
HEBDO in French 18 Jun 92 p 3

[Text] The Spanish state company Inisel and its private counterpart Ceselsa are going to implement a reorganization with a view to forming an electronics center representing a sales figure of some 3.5 billion French francs. The center will consist of four divisions: defense (45 percent of sales); information systems (40 percent); control systems (10 percent); and space (5 percent).

Although the state (through INI [National Industry Holding Company]) will hold a majority share in the initial financial structure of the Inisel-Ceselsa group, the group eventually intends to take on board private Spanish or foreign shareholders.

Applications for Fraunhofer Institute's ESEM Electron Microscope Discussed

92WS0643B Duesseldorf *VDI NACHRICHTEN*
in German 22 May 92 p 6

[Article by Friedhelm Weidelich]

[Text] "On the research scene things are looking up." This is how Rolf Frick, Minister for Science and Research of the State of Sachsen-Anhalt, described the most recent developments on the Elbe and the Saale. The example of Halle makes it clear, according to Frick, that after a rather long period of irritation constructive work can again be done in the realm of science.

This applies especially to the workers of the GDR Academy of Sciences, which had been close to the Council of Ministers, and which was disbanded last year. Application-oriented research and development had been carried on at the Institute for Solid-State Physics and Electron-Microscopy in Halle since its founding in 1960. Since the pure researchers of the Academy of Sciences found a home at the end of 1991 in the newly founded Max Planck Institute for Microstructure Physics, provisions are now also being made for continuity in practice-related project work. Since the beginning of 1992, 16 workers make up the Halle Branch for the Microstructure of Materials and Systems of the Fraunhofer Institute for Mechanics of Materials, which has its headquarters in Freiburg. In April the staff reported for work. The department is headed by Dr. Meinhard Kuna.

The scientists in Halle, who in spite of a divided Germany have cooperated for 10 years with the Fraunhofer Institute in Freiburg im Breisgau, have chosen three areas of concentration. In microstructure analysis they are concerned with microscopic investigations and investigations relating to surface analysis in the deformation and malfunction of materials such as glass, synthetic materials, metals, and composites. Their customers are firms such as Zeiss, Schott, Buna, and Leuna. But also fractures, the processing of materials, and the mechanics of layers are analyzed. The field of subjects ranges from the embrittlement of welded joints in reactor pressure tubes to fractures of soldered joints on heated-up electronic chips.

One task which the Fraunhofer Institute for the Mechanics of Materials has already mastered is the blank pressing of anorganic lenses. The method used, which was developed according to the rough pressing used by the Americans and Japanese in this field, spares the grinding of lenses and reduces the manufacturing costs to a minimum.

The second area of work is called model formation and calculation. Through the analytical and numerical methods of solid-state mechanics (BEM, FEM) the mechanical behaviour of materials and microsystems during deformation, fracture, and malfunction is investigated.

The third area of concentration is a new one—the mechanics of materials of microsystems. Dr. Dieter Katzer of the Fraunhofer Institute sees a need to catch up in research and development in the area of measurement of mechanical parameters. At the same time the large growth potential and short-term profit potential of these

technologies of the future are tempting. "I am expecting a rapidly growing market for systems for microsensor and microactuator technology," says Katzer.

The Fraunhofer Institute should give impetus to East German, and also as much as possible to eastern European industry in building up the economy, Science Minister Frick hopes. Frick wants to help "the ship get underway." For this purpose rounds of talks are planned between the Ministries of Trade and Commerce and of Science on the one hand and the Fraunhofer Society, the Martin Luther University, the chambers of industry and commerce, and the city of Halle on the other. Their aim is the acquisition of third-party funding.

The Director of the Fraunhofer Society institute in Freiburg, Professor Erwin Sommer, is also aware that hard times lie ahead. "Undoubtedly obtaining research contracts will become more difficult in the coming years, since the financial situation of industry, as well as of the federal government and the states will be very strained," said Sommer in Halle. The West German institutes of the Fraunhofer Society finance themselves to at least 50 percent through project research for industry. The goal however, in order to be able to survive, is 80 percent. The Halle branch will have to be satisfied with 10 percent to 15 percent for the first year. For the time being start-up financing by the Science Ministry of the State of Sachsen-Anhalt is helping. "Drumming up customers will be tough enough," a worker of the Institute prophesies, in view of the just now burgeoning middle class and the failed large businesses in eastern Germany. Small businesses also lack the money for ambitious research projects. The scientists of the Halle Fraunhofer Society will have to find their customers mainly in the West.

Siemens Develops Photolithographic Two-Layer Coating System

92MI0681 Coburg *OPTOELEKTRONIK MAGAZIN*
in German Jun 92 pp 76-77

[Text] A photosensitive resist system developed in Siemens's central research laboratories enables integrated circuit structures to be produced photo-optically with a fineness of less than 0.30 micron.

The headlong progress in microelectronics is to a very large extent due to the constant reduction in the size of the structures on the chips. Improved exposure systems, ingenious photosensitive resist systems, and computer simulation of the photolithographic process have made it possible to use photo-optical processes even for structure sizes well below one micron. However, since for physical reasons the image definition of the exposure equipment declines as the wavelength gets shorter and the aperture gets higher, a limit has been reached in which new ways must be found.

Siemens's central research laboratories at Erlangen and Munich have now succeeded in developing a novel two level photoresist system in which, unlike the standard

technology, only a very thin, even layer has to be exposed. The "trick" consists of then transferring the pattern to a second photoresist layer beneath it by anisotropic dry etching. This (much thicker) layer makes for ideal exposure conditions for the thin layer of resist while at the same time being a sufficiently stable mask for subsequent etching processes.

The thin resist undergoes a simple chemical treatment to give it the necessary etching resistance. This process makes possible a controlled widening of the optically transferred structure and thus a controllable scaling down of the empty spaces that will be exposed to the etching fluid. Using this Chemical Widening of Resist Lines [CARL] it has proved possible to make contact holes and insulation grooves with 0.15 micron structures, even though the photo-optical resolution of the exposure equipment was only 0.4 micron.

Mastery of the CARL lithographic process has already been successfully demonstrated in the Perlach research laboratories for 0.30 micron test structures on silicon wafers, and in some cases even 0.25 micron was reached. It will also be possible to use the CARL technique for 0.25 micron technology in conjunction with improved (high aperture) KrF laser exposure systems currently being developed. On the basis of the absorption properties, it seems that it will be possible to convert the resist system for future ArF laser exposure systems with a wavelength of 193 nm; a resolution below 0.20 micron would then be achievable.

By carefully adjusting the phasing position of the light at mask level and in the exposure equipment's lens system, it is not unlikely that photo-optical processes will be able to be sued for finenesses of structure as low as 0.1 micron equivalent to the dimensions on a gigabit chip.

German Subsidiaries of Swiss Lasarray Join EC QUICKCHIP Project

92MI0682 Coburg *OPTOELEKTRONIK MAGAZIN*
in German Jun 92 pp 131-132

[Text] Lasarray GmbH, Heidelberg, and Heidelberg Instruments Mikrotechnik GmbH, Heidelberg, both subsidiaries of the Swiss firm Lasarray of Biel, have since 1990 been successfully involved in the ESPRIT [European Strategy Program for Research in Information Technology] project QUICKCHIPS, project No. 5047. This European research and development project will create novel CAE/CAD [computer-aided engineering/computer-aided design] and production tools for manufacturer-independent development and the quick and cheap production of digital ASIC's [application-specific integrated circuits]. When the German Lasarray firm joined this EC program, the research commission took over the concept and the newly-developed technology from Lasarray exactly.

The QUICKCHIPS ESPRIT Project is Divided into Three Phases:

The first phase (Sept. 1990 - Sept. 1991) is already completed. It involved Lasarray being contracted to develop a direct exposure system based on the DWL [direct writing laser] 0.1.

The DWL 2.0 made in the context of the Community project can be operated as an independent instrument in a semiconductor production line. Conventionally, the various layers are exposed using mask exposure or reticle stepper equipment. The DWL 2.0 can make the identical exposures at all levels and is compatible with the photoresist technique.

This newly-developed instrument allows IC [integrated circuit] manufacturers to carry out the photolithographic exposure steps for individual wafers, such as are required for prototypes and small production runs, more easily, more quickly, and more cheaply (no masks or reticles required). The DWL 2.0 can also make structures as small as 0.8 μm on topologically unfavorable surfaces. A special version of the instrument for mask/reticle writing achieves structures as small as 0.5 micron. A third version of the DWL 2.0 is specially conceived for large-area substrates such as are used for flat screens. The exposure time for a six inch wafer is 90 minutes.

The second phase of the ESPRIT QUICKCHIPS project (Sept. 1991 - June 1992) concerns the manufacturing technology and the equipment, based on Lasarray's ASICfab 2.0, and the completion of "uncommitted design tools" geared to a particularly quick changeover in technology or supplier.

The Lasarray ASICfab is a turn-key mini-factory for making, testing, and packaging gate arrays for any IC manufacturer. It has all the equipment required for multilayer metallization with the corresponding processes, such as the deposition of metal and insulation layers. But since these are not universal processes, the ASICfab 2.0 will be individually customized for the desired technology. The maximum complexity of the chips made depends on the supplier of the base wafers, but it may be in excess of 100,000 gates.

In a planned third phase (July 1992 - Dec. 1994) the tools will be combined into a commercial structure and further developed to give European firms easier access to ASIC technology. To this end it is proposed to found a firm with modern telecommunications facilities and regional design and manufacturing centers. This will in particular also enable small and medium-sized enterprises (SME) and geographically peripheral regions to use ASIC's after getting advice locally, avoiding the usual problems of getting into a new technology, and thus ensuring that their products have a technological lead and remain competitive.

NUCLEAR R&D

Germany: Automated Arm for NET Fusion Reactor Developed

92MI0660 Bonn *TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN* in German
29 Jun 92 pp 11-12

[Text] The prototype EDITH [Experimental Device for In-Torus Handling] of a maintenance manipulator for the planned European nuclear fusion reactor NET [Next European Torus] has now been brought into operation in the Karlsruhe Nuclear Research Center (KfK). The computer-controlled articulated arm which is about 10 meters long is designed for a load capacity of about 4 tons. The equipment has taken about five years to develop in the main engineering department of the KfK and has cost about 6 million German marks [DM]. About 30 percent of the cost has been borne by the "Nuclear fusion" research program of the European Community.

NET is a nuclear fusion reactor with a thermal capacity of 1000 megawatts, planned by the European Community. It is essentially similar in design to the ITER project [International Thermonuclear Experimental Reactor] planned by the U.S., Japan, the former USSR, and the EC. Within the European fusion program, construction of the NET is scheduled to commence in 1996 and commissioning is scheduled for 2005. The same applies to ITER, and it must be assumed that only one of the two projects will come to fruition.

In future nuclear fusion reactors of this kind, the energy-generating hydrogen plasma burning at a temperature of about 100 million° centigrade is enclosed by strong magnetic fields in a ring-shaped toroidal configuration. In previous large-scale nuclear fusion experiments, "normal" hydrogen atoms were used to demonstrate the feasibility of the high plasma temperatures and densities required for energy generation. The actual nuclear fuel, the heavy hydrogen isotope deuterium and the super-heavy isotope tritium was used in small quantities for the first time in the European nuclear fusion plant JET (Joint European Torus) in 1991. Only then do the energy generating nuclear fusion reactions occur in which deuterium and tritium fuse to form helium. The utilizable energy from this reaction occurs essentially as kinetic energy of the rapid neutrons that are likewise produced. These produce radioactive elements in the structural material of the reactor by means of nuclear reactions. This, together with the contamination of the plant fusion reactors, also have to be remote-controlled and remotely maintained and serviced. For these operations on the NET, the Karlsruhe Nuclear Research Center has developed the four-membered remote-controlled maintenance manipulator about 10 meters long which can enter two openings in the outer wall to reach the entire inner surface of the torus vessel. The mechanical stability of the extended articulated arm is an important factor for the fine control required during maintenance operations.

Extensive computer analyses made it possible to optimize the torsional and bending strength of the whole apparatus in spite of the limited cross-section of the individual articulated segments due to the openings in the torus vessel, to the extent that even when the extended arm is at an unfavorable angle with a full load capacity of about 4 tons at the end, the arm is lowered by less than 400 mm—a masterpiece of engineering. In the next development stage, the apparatus will be adopted for use under typical conditions of a nuclear fusion reactor: operation under vacuum at temperatures of up to 150°C and a radiation intensity of several million rad per hour.

TELECOMMUNICATIONS

French Telecommunications Minister on Deregulation

92BR0580 Paris *ENTREPRISES & TELECOMMUNICATIONS* in French Jul-Aug 92 pp 76-78

[Interview with Emile Zuccarelli, French minister of post and telecommunications, by Herve Marchal: "Pushing Reform, But in a Balanced Fashion"]

[Text] The policy of the new minister can be summed up in two words: balance and reform. In his opinion, the status of France Telecom is an excellent blend of public service and competitive flexibility. Therefore, there is no need to privatize. Calculating that France has spent a small fortune on opening up (the mobile phone and satellite link) markets, he is calling for a status quo on the telephone network. Finally, he defends a new-look industrial policy which is flexible and efficient within the Community, but steadfast vis a vis the Americans and Japanese.

ENTREPRISES & TELECOMMUNICATIONS

[E&T]: You have just announced the opening or continuation of 12 projects. How are you going to complete these major undertakings—so reminiscent of Michel Rocard's "Herculean tasks"—between now and the next elections, in other words, in less than a year?

Zuccarelli: It would be rather boastful of me to claim that these 12 projects will be concluded within the few months in question. But governments always function on a continuous basis and I am therefore merely carrying on what was done before, particularly with regard to reforming the sector. In any case, I hope that some of the projects will be concluded within the coming months, and those that will not I aim to give a flying start.

What we need to do is make rapid progress and act dynamically. Let me take up a single example, namely the reform implemented 18 months ago. Well, 1991 saw the emergence of the new public telecommunications operator, France Telecom, henceforth organized like a public company: company auditing, analytic accounting, legal procedures, new contracts with customers, etc.

Finally, a previous long-term planning contract [contrat de plan] between the state and the public operator consolidated this new organization and asserted its corporate autonomy.

In 1992, this reform will reach maturity. All we need to do at the moment is pursue international development and reinforce the tools of strategic planning and management as well as the legal means. For France Telecom, 1992 is also the year in which we will press on with the social part of the reform which, while engendering profound changes with respect to the grades and classifications of staff, represents a reform the likes of which has not been seen in recent decades in the public sector. And I am well aware that we must push ahead with this social reform without delay. I think that, in the coming 9 or 10 months, we must do everything we can to ensure that all that remains to be done thereafter is sit back and let the natural rhythm of these events unfold.

In order to attain these objectives, France Telecom has also started to implement a new internal organization so as to fit in better with its environment and meet the expectations of its customers, both professional and regular ones.

E&T: As far as this reform is concerned, some people claim that it has not gone far enough and are demanding the privatization of France Telecom pure and simple. Do you believe that things actually have to be taken that far?

Zuccarelli: The reform is a good one precisely because it constitutes an excellent balance between the need to be faithful to a tradition of public service—in a strategic sector where the extent of state control remains large—and the opportunity given to the operator to pursue competitive activities and to adapt with the desired flexibility to an environment which is subject to very fast technological change. That is why this reform is well balanced.

So when it comes to privatizing France Telecom...why should we wish to change something that is working so well? To me it would be like creating a problem where there is none. We do have to have an efficient public operator. And in the current context, it has the means to be just that. Of course, ideological pressures are always exerted by those for whom privatization has an inherent symbolic value. But that is not at all the way in which I approach the issue.

E&T: The Directorate on General Regulations (DRG) is implementing a policy which involves opening up specific sectors and services to competition. Is this process going faster than you would like?

Zuccarelli: This is a fairly recent directorate and one which is held in high esteem by my ministry. It is not intended to take action independently of that taken by the minister. The DRG is one of the government's instruments of action. In the context of the guidelines which it has been given, it is a division which is working very well. Its mission is not to liberalize the sector, nor is it to privatize;

it is to ensure that regulation complies with the legal framework which we have established in Europe and in France. Having said that, it needs no further stimulus. In some areas (mobile and satellite communications), the ministry has anticipated Community directives. These are sectors where competition enables the market to develop along the lines anticipated (mobile telephony, radioelectric distributed networks, VSATs [very small aperture terminal]....to mention just the best-known examples) without impinging on France Telecom's monopoly on wire infrastructures open to the public which are now highly efficient. Thanks to the action we have taken, the face of the telecommunications sector has been radically transformed over the last 2 years. This transformation has followed the development of the sector, without any other *a priori* factors. In 1987 there was a European Green Paper on telecommunications, followed in 1990 by a national law. These texts have been most diligently and effectively implemented by the Ministry of Postal Services and Telecommunications.

The diligence with which we have applied the European regulation makes things very comfortable for us today, although we must take care, for the European directive of 1989 provides for an assessment of how well the telecommunications sector is functioning within the framework of this new regulation. Depending on the results, it might lead to slight modifications in two years' time. However, as we are starting out on the basis of a European regulation which works and which is the object of overwhelming agreement, there is no need to take hasty action. If corrective measures indeed have to be applied to this balance, they will only prove possible after prior and extensive consultation with the member states. However, we shall vigorously oppose any changes which might excessively disrupt this balance.

E&T: The British Secretary of State for Trade and Industry Peter Lilley recently stated that the British would like to see competition applied to the basic network, the telephone network. Will you go along with this kind of development?

Zuccarelli: The 1989 agreement did not include voice telephony in the open sector. The review of this very important issue would constitute a very major and serious shift in the balance which we attained at that time.

E&T: Nevertheless, on 1 July it will be the turn of the British to take on the presidency of the Community....

Zuccarelli: The European Community comprises 12 member states and the presidency naturally offers possibilities to alter the timing of certain issues and deal with them at a faster or a slower pace. However, it does not offer any way to radically alter existing balances.

E&T: France seems to be well placed in the telecommunications sector; it has strong manufacturers and a healthy operator. This shows that the State knows what it is doing. What do you see for the future in the light of this situation? Are you optimistic?

Zuccarelli: Over the last 20 years we have witnessed tremendous expansion in the telecommunications sector, even if the sector has more recently been facing up to three challenges: First, the slackening off of growth insofar as the basic equipment has, for the most part, been produced, second, the deregulation of markets associated with the internationalization of activities; and third, the extraordinary rate of technological progress. These challenges are demanding on the national operator and our entire industrial fabric, but France has a much-envied public service and recognized know-how.

Our strong points are considerable. We now have a very strong image, thanks to the achievements of the last 15 to 20 years. Our telecommunications network is among the best in the world. Technological choices favoring digital switching gave us a leading edge and enabled us to develop technical masterpieces and commercial successes, such as minitel [videotex system] or Numeris [France's integrated services digital network (ISDN)].

Our industrial fabric includes the world leader, Alcatel, a major international symbol of quality and reliability. Our manufacturers are developing a number of technological niches, such as TRT [Radioelectric and Telephone Telecommunications Company] in the area of rural telephony with a market share of 40 percent, and SAGEM [Company for General Electricity and Mechanics Applications] in the area of printed text transmission and also in directional radio links and fiber optics. In addition, the 1992 telecommunications revenues of the Matra group will amount to something like 8 billion French francs [Fr] in 1992.

I would like to add that we still need to coordinate the activities of our public and other companies abroad. This is one of my concerns. But I am convinced that we have the potential to remain among the world leaders. So you see I am decidedly optimistic and, on top of that, I am ambitious for our country.

E&T: Your 12 projects include electronic bulletin boards. This is a problem which has been afflicting the sector for months. How can the need to conserve this free domain be reconciled with the establishment of a reasonable regulation?

Zuccarelli: This is a social problem which arouses many—and varied—reactions. My view is not to let this business drag on, but rather to give it due consideration before the issue is raised too eruptively in public. In fact, bulletin boards can pose two kinds of problem: First, they may upset people. In this case, we must look at solutions such as access keys, locks, or call parks, i.e., codes enabling parents to control access. Secondly, and this problem is of a criminal nature, they may advertise illegal actions, racism, or even violence. Here, the punitive step to be taken at one time or another is to impose a ban. Nonetheless, we cannot carry on like an arbitrary censor, so we have to think about the authorities likely to pronounce such a ban. When all is said and done, it is a minister who will have to ratify the decision, but he will

cover himself with all kinds of precautions, either by referring to the legal order or by referring to an ethics committee which still remains to be set up.

E&T: Another subject close to your heart is mobile phones.

Zuccarelli: We are familiar with car phones, but telephones for carrying around with us everywhere we go are an entirely different matter. The market for such a product is phenomenal, and still in its infancy. The dilemma remains, however, of how to manage the frequency spectrum. This problem will become acute in the next few years. Frequencies are gradually becoming a rare commodity, and I have my doubts as to whether their status as a free resource, which is widespread, can persist much longer.

E&T: Let us return to the subject of Europe, if we may. Is there still any sense in talking about industrial policy at Community level for telecommunications and the entire electronics branch?

Zuccarelli: We are having to embark on a new phase of European construction. In fact, we must strengthen our industrial power. Harmonization must not be allowed to weaken French and European companies. We cannot allow Europe to be a simple free trade zone, a sort of soft-bellied economy.

Consequently, I am hoping for the establishment of a firm industrial policy in both the telecommunications and electronics sectors.

This industrial policy must translate into several forms of action. First of all, reciprocity agreements must be concluded between European, North American, and Japanese interests. The European market cannot be left wide open to competition from outside Europe if our companies are denied access to American and Japanese markets. So we need to go further than the inadequate reciprocity which exists today. When we have achieved this, telecommunications in Europe will be affected by the mergers and restructuring of its industrial entities. In fact, in order to remain competitive after the vertical integration of the Americans and Japanese, European manufacturers will have to conclude vertical strategic cooperation agreements. The Community must refrain from impeding such rapprochements on the grounds of its criteria concerning the control of mergers which, obviously, do not apply to the giant American or Japanese concerns.

Moreover, we have to encourage research conducted within the scope of market-oriented projects and increase user participation. In this respect I am in favor of developing a dialogue between industrial concerns, services suppliers, and users aimed at defining tomorrow's products, especially terminal equipment.

In order to achieve these objectives, I would like to stress that France Telecom has to play an active supporting role in our industrial policy. It is doing this by means of its

international activities in Mexico (share holding in Telmex, the national operator), in Argentina (entry into Entel), and Poland (involvement in cellular mobile phone project). All these operations at the same time enable manufacturers from French or European industry to make inroads into these markets. Finally, through its policy of making purchases and providing new services in consultation with industry, France Telecom, whose investment level amounts to over Fr35 billion per year, is a powerful lever of growth for European manufacturers.

E&T: High-definition television (HDTV) is one of your major preoccupations and constitutes a kind of new technological barrier for France and Europe. And yet it is proving hard to make progress in this area.

Zuccarelli: HDTV is a sector in which Europe is playing a leading role. During the Winter Olympics in Albertville, France broadcast high-definition images for two weeks from 50 different sites. In Barcelona there will be 200 sites. Europe has another advantage, and that concerns the standard. The United States was last off the mark in developing HDTV and is seeking to vault directly into the final phase. However, there is no reason to believe that they will make it into the final phase as soon as some people are suggesting. They still have not decided which digital system to use, and they themselves have announced that they will not be ready before 1998, at the earliest. This means that we in Europe have all this time to develop our technological choices...provided that we waste no time in doing so. In other words, we have a certain edge.

E&T: Is France not rather isolated in this case?

Zuccarelli: Not at all. The support of our German partners was quite clearly reinforced yet again at the last summit in La Rochelle. This is an area in which we are convinced that we have to make swift progress. Especially if we are to solve the French internal problem. After all, we have no shortage of assets and arguments at our disposal to ensure that things move along swiftly.

E&T: Some people say that you are tackling the problem of cable links. Would it be fair to say that there is a French cable disease?

Zuccarelli: Cable has not yet given us everything it is capable of providing. Our situation, compared with that of other, neighboring countries, is short of satisfactory. That is why we are trying to remedy this situation by facilitating its installation in blocks of flats; by simplifying commercial procedures for customers, who in future will have just one interlocutor; by lowering prices thanks to a major effort on the part of France Telecom; by improving the range of programs on offer; and particularly by allocating more time to films. This incentive project, which was recently presented in the Council of Ministers, will prove effective provided that the adopted measures are followed up.

Forty Companies Adopt D2-MAC Standard

92BR0590 Paris *ELECTRONIQUE INTERNATIONALE* HEBDO in French 18 Jun 92 p 3

[Text] However small, the advocates of European HDTV [high-definition television] achieved a victory: Forty European companies or associations, including program broadcasters, satellite operators, and manufacturers of consumer equipment, signed the Memorandum of Understanding for promoting European HDTV and its intermediate D2-MAC standard in the 16:9 format in Brussels on Monday. This statement of intent is not linked to any legal sanction which could be applied to those who fail to meet their commitment; it constitutes a preliminary document which will enable the European Commission to grant aid to projects, selected on a case-by-case basis, through bilateral contracts concluded between the Commission and the applicant. The broadcasters who signed the document have accepted to prepare an operational project to start broadcasting programs in 16:9 D2-MAC format by satellite or via cable networks. Manufacturers, in turn, have undertaken to produce sufficient quantities of D2-MAC 16:9 television sets. The contribution of satellite and cable network operators will consist in reserving sufficient capacity for broadcasting programs based on these standards.

Italy, CIS Sign Telecommunications Accord

92MI0641 Milan *ITALIA OGGI* in Italian 15 Jul 92 p 13

[Text] STET [Turin Telephone Holding Company] has signed a protocol of agreement with the Russian Ministry of Communications and Intertelecom in Moscow that gives rise to the ITUR project.

"The ITUR project," reads the press release, "provides for the development of a telecommunications link using submarine fiber-optic cables to connect the Palermo node with Novorossiysk (Russia) via Istanbul-Odessa. Novorossiysk will also be connected with Rostov (on the Don river) and Moscow via a ground link on Russian territory and two international telephone exchanges in Moscow and Rostov."

This project will extend the range of international telecommunications links in Russia and facilitate the modernization of networks to meet growing needs of business users created by the establishment of new industries in the country including the Don region. The STET group companies involved in the project are: Italcable [Cable and Radio Services], Sirti [Stock Company for Research, Design, and Installation of Telecommunications Facilities], and Italtel [Italian Telecommunications Company].

Improvements to German Btx Videotext Service Planned

New Functions for Btx

92WS0694A Heidelberg *NET—NACHRICHTEN ELEKTRONIK + TELEMATIK* in German Jun 92 pp 302-303

[Text]

"The Full Range of Btx Functions Will Be Retained"

Practically no other of Telekom's deficit-ridden services has come under such heavy fire from critics as Btx [Bildschirmtext, videotext]. Instead of finally withdrawing the much-maligned service from the market, Telekom has recently presented a new concept which gives Btx a new purpose. In the future, the communication platform Datex-J is to take the beleaguered service under its wing and help it reach new heights.

NET: Mr. Danke, the videotext concept did not live up to its earlier promise: The number of users and providers of external computers is growing only slightly, the number of information providers is sinking. The result is hundreds of millions in unrecovered costs annually. Is it worth throwing yet another lifesaver to the drowning service?

Danke: It is indeed true that videotext costs are not covered by receipts. However, it is also true that with about 300,000 connections in recent years, Btx has developed into one of the most heavily subscribed services of the DBP [Deutsche Bundespost, German Post Office]. Usage has risen continuously and, with a total of about 7 million links and an average of over 7 hours per connection per month, it is also very high in comparison with other countries.

NET: Then could everything stay as it was?

Danke: Naturally Telekom also wants to operate Btx economically and thus maintain it. For this reason alone considerable funds are being invested in the conversion of the system. We see a continuing demand for qualified interactive applications and want to offer the optimal solution with our design.

Slight Additional Charge

NET: How does the "renovation" of Btx look in detail?

Danke: For one thing, the costs will be considerably reduced through the conversion to a new Btx access network as well as through the optimization of procedures. For another, however, the receipts situation must be improved. In particular, Btx utilization cannot continue to be offered almost free of charge. In the future, a user fee, albeit a small one, must be imposed.

NET: Can you be more precise?

Danke: A rate of a few pfennigs per minute with a marked reduction during the off-peak period is being considered. One model starts from 6 and 2 pfennigs per minute, which corresponds to 3.60 marks or 1.20 marks per hour.

NET: Is this increased income sufficient?

Danke: We start from the assumption that the number of users will continue to grow as in past years. That would be sufficient to be able to continue operating the service permanently on a cost-effective basis. In addition, new marketing approaches should contribute to reducing the

losses of the past through higher sales. The costs will also be lowered by giving up the Btx-owned access network.

NET: In recent weeks, there were some very contradictory things to be heard and read concerning the new access network Datex-J, which is supposed to take the place of the Btx network. Therefore the question again: When will the new network go into operation?—And especially: Will Btx be kept in its present form?

Danke: The new access network will replace existing technology from the middle of 1992 to the end of 1993. This will guarantee that the present range of Btx's functions will be completely preserved. Existing applications will continue to be useable without restrictions. All users thus have the necessary long-term planning security.

NET: Are functional expansions also linked with the conversion to Datex-J?

Danke: Yes. For example, the existing Btx access network will develop into a neutral communications platform which is suitable not only for Btx, but also for general data transmission to computers in the Datex-P network. Field representatives, for example, can then dial up the computer of their service center under favorable conditions using the universal telephone number 0 19 10. Furthermore, the transmission rate for all access in the analog network will increase to 2400 bits/s and in ISDN [integrated service digital network] to 64 kbits/s. Access to especially sensitive data can further safeguarded using smart-cards.

Success is a Question of Commitment

NET: Let's come back to marketing. It is known that Telekom wants to achieve greater user-friendliness by aiming at definite target groups. Professional business applications, provider Btx and application Btx are being discussed as application packets. How can these services create the basis for the continued growth of Btx?

Danke: The central point of this approach is the creation of so-called application containers backed by providers with clear services and for each of which there is a definite target group. In marketing, the measurable benefit for the end user should be in the foreground. The focus will be on the creation of open application containers. That means they are available to all Btx users and allow access to other Btx services. The marketing success of such applications will also benefit other Btx providers, since it increases their range as well. A typical example is the "Infotext Reise" service from the Federal Railway, Lufthansa, and local transportation companies.

NET: Ultimately, doesn't that mean that the success of the concept depends upon the providers' supplying and marketing services which are actually useful?

Danke: Yes, precisely.

NET: How does Telekom's collaboration with the publisher Axel Springer Verlag fit into this picture?

Danke: The goal of both firms is to develop through the joint company VideoTel Infoservice a user-oriented quality service for the private mass market. Applications which are oriented towards a broad target group and fill definite quality demands will also be given the opportunity to be present in VideoTel's application container.

New Functions

NET: One problem which Telekom repeatedly complains about and which is viewed as a cause of the plight is frivolous providers who rush into Btx. As is known, because of the agreement with the Federal states, Telekom can have no influence on either the content or the structure of the services. Will something change in this regard?

Danke: Private users above all expect homogenous and generally high quality applications. However, based on the present legal position, no change is in sight here. In order to be better able to separate good applications from frivolous ones in the directories, the possibility of direct access to applications with *code# was introduced. With it, every provider can replace the page number in his advertisement with an easily noticeable code which guarantees access exclusively to his application. In addition, the Neue Mediengesellschaft is developing an overview of good applications of general interest under *COM#.

NET: What other new functions are planned?

Danke: Especially worth mentioning here are provider-specific general surveys which allow individual applications or application packets even greater independence. The so-called Page 0 will be entered upon demand in the user's record and with every direct or indirect call will be displayed in place of the Btx general overview. An individual welcome page goes with every provider-specific Page 0, so that the user sees an almost provider-specific system. Page 0 can be set up as an open or as a closed page. An open Page 0 allows direct access to all other Btx services, while with a closed page a maximum of 20 additional pages can be accessed. Such pages can only be set up for nationwide directories and, because of the price, are only of importance for larger applications.

New Datex-J Access Network

92WS0694B Heidelberg *NET—NACHRICHTEN ELEKTRONIK + TELEMATIK* in German Jun 92 pp 306-308

[Text]

What Will Datex-J Bring the User?

In order to be able to operate Btx [Bildschirmtext, videotext] cost-effectively, Telekom decided to provide new impetus with a new access network called Datex-J and improved marketing. The following article describes the technical and economic aspects associated with the changeover.

Hard to believe, but true: In the first nine years of its existence, Btx was significantly more successful than the telefax service, generally viewed today as a "winner." A glance at the statistics confirms this. On April 26, 1992, after nine years, Btx had a total of 311,013 subscribers. Telefax, in contrast, experienced ups and downs and on December 31, 1988, had only 197,245 connections. Admittedly, business communication is inconceivable today without the telefax service, which has more than a million connections. And who knows the exact number of connected telefax machines in Germany, a figure which is certainly even higher?

These days especially, when only a small volume of conventional mail can be received or sent because of the strike situation in government service, we feel cut off from the outside world without telefax. Yet four years ago people managed to get along largely without fax service. Even in 1988 there were those who maintained that telefax would never really "make it."

Btx Between Success and Failure

Similarly, there were always critics at Btx in past years who spoke of a flop, a failure, and the like. But here it is worth drawing a distinction:

Btx was and is a very successful business communication service which, for the first time, provided many decentralized user groups with user-friendly and affordable host access.

Btx was and is less successful if distribution in private households is used as a criterion for its evaluation. There are surely numerous reasons for this. However, it is also certain that Telekom alone cannot be made responsible for the lack of success in this area.

A few weeks ago Telekom announced that the Btx concept will change fundamentally in the near future. These changes concern both the technical infrastructure as well as the Btx marketing concept. In the following, the most important technical innovations will be explained briefly. The main questions to be discussed are which changes in fees are in store for the user and which costs will arise from utilization of the new Datex-J service.

Technical Infrastructure

The most important technical changes will be:

- The "Btx computer" (IBM series 1), more than 10 years old, will be replaced by IBM minisystems which are cheaper to purchase and more powerful.
- The number of exchanges will increase noticeably. While today there are 50 exchanges in 37 localities, by 1995 a total of 150 exchanges will be built. Thus the exchange service will move closer to the subscribers.
- An outstanding characteristic of the new systems approach will be that the access computers will be

reached exclusively via ISDN [integrated service digital network]—for existing and future analog Btx connections as well. All access computers will be equipped with ISDN primary multiplex connections, which will not only make available to subscribers the full ISDN rate of 64,000 bits/s (instead of 1200/75 bits/s), but will also noticeably increase the port capacity of an exchange (1440 instead of 560 as before). In addition, a rate of up to 2400 bits/s will also be available even in the reply channel for intelligent terminals without ISDN capability. In about 2 to 3 years, further performance characteristics will be added, such as the possibility of using the MNP5 and V.42bis protocols as well as the even higher access rate of 9600 bits/s.

—As before, external computers will only be connected via Datex-P. It is significant here that the simpler X.29 protocol can also be used in the future along with the EHKP protocols (Einheitliches Hoeheres Kommunikations-Protokoll [Uniform Higher Communication Protocol]).

—The real innovation in systems approach is that the Btx-owned or Btx-specific access network will be abandoned. In the past, the Btx system and Btx applications based on it—on which Telekom, except for their own applications, has no influence because of the Btx government contract—were thrown into one pot. Or in other words: Poorly structured and sometimes frivolous Btx services from individual Btx providers, along with all their accompanying disadvantages for the user, were frequently blamed on Telekom.

This will change in the future. By abandoning the Btx-specific access network, Telekom will make it clear that in the future a new and more powerful but application-neutral network, for Btx as well as others, will be available. Using the new communication platform of an "added value data network" with the service designation Datex-J (J = Jedermann [everyman]), a distinction will be made between the various possible Btx uses and pure applications for data transmission. Thus code-transparent, professional data communication applications with the usual presentation formats will be possible in the Datex-J service. For applications with the protocol VT 100 and later also SNA 3270, there is the major advantage that hitherto unavailable network access possibilities will be offered because of the large number of exchanges that will be available when the system is completed and because of the high regional visibility of the Datex-J service. Telekom hopes that Datex-J, as a possible transition from the telephone service (primarily analog) to the Datex-P network, will one day assume the function of a "Volks-PAD" ["common man's packet assembler/disassembler"] with far-ranging applications.

ISDN, Datex-J and the Costs

This new communications platform offers fantastic options, above all for ISDN users. If ISDN-Btx can now respond satisfactorily to all the criticisms made of analog

Btx with 1200/75 bits/s on the user side—very fast dialing procedure, very fast picture synthesis, etc.—then potential ISDN users in particular should feel enthusiastic about the future applications of a packet-oriented and volume-dependent service in the D channel connected to the Datex-P network via the new communication platform. This is particularly true for economic reasons—and thus we arrive at the anticipated cost of using the Datex-J service.

Let's begin with the ISDN rates. Consulting projects and conversations with potential ISDN users indicate that ISDN is viewed as a sort of miracle cure which can revolutionize the entire field of data communications. It is true that ISDN fixed connections as well as ISDN switched connections, on the basis of which short, rapid file transfer occurs, cannot be beat in many application environments from the viewpoint of cost and efficiency. There is certainly an important exception: Classical on-line interactive applications, a variety of which have been developed in recent years based, for example, on the Btx computer network, cannot be supported economically with ISDN.

Such applications should be developed principally on the basis of Datex-P (or the Btx-computer network), since data transmission can only be supported economically through a volume-dependent rate for smaller quantities of information per interactive step. In this application environment, ISDN offers a cost-effective alternative with packet-oriented transmission in the D channel (with max. 9600 bits/s). In conjunction with the new communications platform and with the realistic assumption that Datex-P will be offered as a value added service of the basic ISDN connection at distinctly lower costs than today's Datex P10H, which has a comparable speed, ISDN may be interesting for such types of applications—and then some. Even today the transfer of the ISDN connection to Datex-P with a transmission rate of 9600 bits/s is clearly more economical at 340 German marks [DM] per month than the corresponding Datex P10H with a basic monthly fee of DM 420.

The question of which user fees are expected for the "Volks-PAD" should also be of great interest for potential Datex-J users. After all, a Datex-P exchange can be dialed over the telephone network today and the local PAD function can be used.

It can be said in all probability today that Datex-J will have clear cost advantages here as well. Two differences from today's PAD dialing must be noted:

—On the one hand, the Volks-PAD can be reached as a rule in 6 minute cycles. In unfavorable circumstances,

modern PADs in the Datex-P exchanges at the 32 sites can be reached via telephone access at long distance rates. Up until 18:00 hours, it is possible to communicate for 21 seconds for DM 0.23, and after 18:00 hours it is possible to communicate for 42 seconds for the same amount.

—On the other hand, only the normal charges per minute apply for the use of the Volks-PAD, which generally also cover the use of the Btx system. Rate models which will probably apply in the future begin from the assumption that one minute of use will cost 6 pfennigs [pf] (in addition to the normal telephone rates) up until 18:00 hours, and after 18:00 hours it will cost only 2 pfennigs. If one compares this with the various costs which apply when a selected virtual connection is made over the Datex-P telephone access, the results are: switched access: 4 pf/minute, adaptation charge: 6 pf/minute, domestic connect charge: 1 pf/minute. The charge for the Datex-P telephone access thus comes to a total of 11 pf/minute. To this is added the loading charge of 5 pfennigs per switched connection, which, however, is not taken into consideration here because it is not yet known if it will also apply for use of the Datex-J service. That means that the Datex-J service, in comparison to today's PAD, will have far-reaching cost reduction potential.

Telekom is on the right track with the creation of a new added value data network or the systems operation of a service-independent communication platform. Thereby it will not only be able to noticeably reduce the internal costs for construction and operation of the system in comparison with the present, but in the future it will also offer the users significantly more extensive and economical data communication configurations. All ISDN users in particular will profit from this, since for the first time classical online interactive applications via the ISDN access to Datex-J will make sense economically.

The future position of Telekom as the provider of a principally application-independent network alternative over which Btx applications can also be accessed will contribute significantly to objectifying the discussion about the alleged failure of the Btx system. It will then be clearer that the quality of the information offered by private providers and the subjectively deducible advantages for all subscribers can ultimately have an influence on success. Systems restrictions due to technical problems along the lines of "Btx is slow" will then finally be a thing of the past. Want to bet that in four years, as with telefax, we will scarcely remember the "unsuccessful" Btx service?

AUTOMOTIVE INDUSTRY

Hungary Develops Electric Automobile

92MI0647 Milan *ITALIA OGGI* in Italian 21 Jul 92 p 14

[Article by Pietro Veneziani: "Puli; An Electric Automobile With An Italian Engine"]

[Text] Puli is a charming, shaggy breed of Hungarian dog and the name of a small electric city automobile which met with great success at the international trade fair held in Trieste recently, following the success also attained at the Milan and Bern trade fairs. Puli, a two-seat electric automobile is small, simple, economical, and can be easily recharged using a normal household electrical outlet. It is quiet and nonpolluting.

Increased ecological awareness resulting from the growing difficulty of living in cities has led to a market demand for electric automobiles in urban areas. These automobiles are usually transformed from fuel-powered cars and normally have a 60-kilometer range when running at 60 kilometers per hour. In Europe, electric automobiles are already a common sight in urban areas. While Switzerland and Germany are taking the first steps in this sector, France already has a market demand of more than 10,000 automobiles per year, a direct result of its clear, well-defined legislation.

This legislation provides for two classes of electric automobiles that can be officially approved without having to undergo the crash test required for automobiles.

The first class weighs 350 Kg and has a 4 kilowatt maximum propulsion power. The vehicle may be driven on all roads except for highways without a driver's license. The second class is the same size, weighs up to 400 Kg and has a maximum 9.6 kilowatt propulsion power. It has four seats and a license is required.

Electric cars have a fiberglass, shock-resistant plastic body. They are compact, safe, and lightweight. Their small size makes them easy to park and gives them maximum maneuverability in the city.

In Italy, the absence of electric automobiles is unjustified. The problem is not technical, but as always, political.

The Puli electric city automobile has two seats, a 300-liter trunk, all the modern comforts and comes in both a sedan and a convertible coupe version. It was made in Hungary and has an Italian engine.

The chassis is noncorrosive steel. The body made of shock resistant plastic, comes in white, yellow, or red. The direct current electric engine has a 70-kilometer range and can be completely recharged in eight to 10 hours at a cost of 2,000 lire using a normal household 220-volt alternating current outlet. The maximum speed is 65 kilometers per hour.

SCIENCE & TECHNOLOGY POLICY

Hungary: Government Short-Term S&T Policy Draft Presented

Industrial Policy

92WS0759A Budapest *FIGYELO* in Hungarian 16 Jul 92 p 14

[Unattributed article: "Short-Term Industrial Policy Concept, Part I"]

[Text] The Industrial Minister promised a medium and long-term industrial policy concept for the fall. The work began with an analysis of the present situation and a formulation of the "fire fighting" tasks. And so, as a result, the government recently discussed and adopted a "short-term program for the management of industry" out of this. In the first part of our series, without trying to be complete, we describe the program itself; in our next issue we will analyze it from several viewpoints.

The industrial policy and crisis management system described and recommended and the practical application thereof will permit the government to carry out its economic policy tasks for 1992 so that the industrial, development and employment programs will be fulfilled in a way approximating the thinking thereon.

The most significant changes have taken place in the organizational transformation of state enterprises. The number of monopolies has decreased and the trusts (OKGT [National Oil and Gas Industry Trust], MAT [Hungarian Aluminum Industry Trust], MVMT [Hungarian Electric Works Trust] and the Brick and Tile Industry Trust) have been formed into economic associations. The explosive increase in the number of small enterprises and economic organizations—especially those with fewer than 20 persons—has continued.

Enterprises are significantly differentiated according to their performance capability. An enterprise group capable of changing markets and of ownership transformation has developed. Another group of enterprises, primarily those specialized for the former CEMA market, has gotten into a critical situation. This group includes those management units the products of which are viable and whose management is efficient but due to the business crisis their market possibilities are unfavorable. Keeping these enterprises "on their feet" must be aided with government tools.

A third enterprise group has become unviable due to uneconomical production which is very demanding of material and energy. Their transformation is slow and due to their liquidity problems bankruptcy is inevitable for the majority of them.

The development of the international and domestic economic environment decisively determines the industrial processes for 1992. With the signing of the agreement there will be no duties on industrial export worth

about 1,400 million dollars. Thus, in 1992, industrial products are getting a significant duty advantage, the value of this can be estimated at 160 to 170 million dollars which, in itself, will increase our convertible export by 1.6 to 1.7 percent at the annual level.

Crisis Management

If the government behavior does not change the recession will continue and even viable enterprises will go bankrupt. It is necessary for the state, as owner, to take part in aiding structural change by assuming part of the risks, guaranteeing tools, with reorganization prior to privatization, by creating new jobs in the capacity freed and by managing the crisis phenomena which necessarily accompany the transformation.

The starting principles for a crisis management strategy are as follows.

The government cannot alone assume the general crisis management for the entire economy; the responsible participation of local economic-social organizations and self-governments is indispensable in solving the problems.... In managing the crisis phenomena it is not realistic to support, even temporarily, in the manner of deficit financing, activities which cannot be made efficient, which would prolong the crisis.... It would help a solution of regional crisis situations, coupled with backwardness, if crisis management were accompanied by the realization of regional development programs for the producing and human infrastructure and environmental improvement. Hungary today does not have such programs, professionally well founded; it is a recurring problem that concrete development projects cannot be offered to foreign investors. Although, under present economic conditions, a comprehensive, broad program for catching up in regard to the infrastructure cannot really be started in 1992, it is necessary to begin detailed development of such a program and concrete development projects. Developing a system of tools for managing the crisis is an urgent task, because the crisis phenomena have strengthened with the going into effect of the bankruptcy law. The government must slow this process with well thought out monetary tools to handle bankruptcies.

As a first step we have designated those enterprises (companies) which are in a difficult financial situation due to state fund awards connected with earlier developments, due to state loans, large, long-term credits or debts vis-a-vis the budget. These enterprises have orders for their goods, have well trained expert staffs, there is a market for their products, but primarily due to their liquidity difficulties they probably will not be able to continue operation in the course of bankruptcy proceedings. Government intervention is needed to manage their debts.

Naturally, even outside the designated enterprise sphere, there are other enterprises the fate of which is now being decided in some way (the OKU [Ozd Metallurgical Works], the OART, the DIMAG Company, the Csepel

Auto Factory, the Paper Industry Enterprise and the HUNGALU Company). There are also industrial management organizations with smaller incomes which require similar treatment when one considers their strategic situation, regional employment policy status or national security interests.

It would be a good beginning for the TB to entrust a specialized firm with appraisal and sale of property being offered to settle the obligations. A large part of the enterprise obligations have piled up in certain supplier circles and public service areas (electric power, gas, water, sewage). To settle these obligations we recommend that the enterprises get medium-term credits with low interest rates; the cover for these might be their real estate intended for sale. In preparation for a structural transformation of enterprises foreign expert firms have been brought in, within the framework of the Enterprise Reform Loan offered by the World Bank, to make clear the situation at seven enterprises; preparations for such studies have begun at 50 enterprises. Financing will come in part from World Bank credit but probably in larger measure from Japanese government aid and from contributions from the Hungarian Development Fund. The Hungarian Investment and Development Company should support an acceleration of industrial structural transformation and privatization by raising base capital from transferred privatization receipts, by buying capital shares and with favorable financial deals. This credit should be offered primarily for starting developments in harmony with structural policy goals or in connection with the chief goals of research and technical development.

The new institutions recommended by the ministry, the Regional Economic Development Associations, would help solve the economic problems of the regions by finding resources which might be made to flow into the regions, by a more coordinated use of existing funds, by working out regional development programs and actions and by providing market information. Central and local government organs, commercial banks, interested foreign and domestic investment firms and enterprises already operating in the affected regions might jointly provide the money needed for the operation of these associations and for averting a crisis.

The most critical consequence of the development of crisis situations is the increase in the number of unemployed. Supporting the proposal of the Regional Work Committee of the Economic Cabinet to stop this process we agree with the creation of Employment Associations. In addition, an expansion of the commercial network and the development of the service sector is a significant factor in solving the employment problems of the regions.

Small and medium size undertakings have a significant role in resolving regional inequalities and tensions. For this reason favorable, low interest rate credits are needed to increase the number of jobs and create new jobs.

After Tomorrow

We have begun to develop a long-term industrial policy strategy. A system of tools to support industrial policy must be realized in encouraging privatization, in encouraging undertakings, in supporting small and medium undertakings, in increasing export performance, in encouraging investments, in technical development, in transforming the R&D institutional system, in environmental protection, in environment management and in the area of industry and market protection.

To encourage privatization and the change in product structure and markets the Ministry of Industry and Trade has initiated the organization of a Structure Transformation and Privatization Investment Company—to be formed with state participation.

For example, the following tools might be used to encourage undertakings and support small and medium undertakings: investment supports, credits with more favorable conditions and offering credit guarantees to start an undertaking; state purchase of shares to aid access to venture capital, creating institutional conditions for offering venture capital; organization of Business Innovation Centers; building up an information network and an infrastructure to serve the undertakings; and creating entrepreneurial "incubator houses."

Industry and Market Protection

In the interest of improving export performance and within the framework of a modernized export competition system we must create conditions more favorable than the norm (for example in the form of technical development support) for developments which are aimed at developing competitive export products. We must also aid in getting products on the market by expanding the network of commercial offices operating abroad.

The task of the research and development programs and of the targeted competitions is the development of research-development-innovation-market consortia serving economic priorities which can receive central support.

New organizations formed in part from united holding companies and the privatization of institutes and development enterprises will serve a reorganization of the institutes and of the entire R&D sphere.

The following measures (among others) will create conditions for quality development: a review of the status of official authorization systems and quality control institutes and creation of a new accreditation system. An initiative to create a Quality Affairs Center. An R&D policy which treats environmental protection and environment friendly technologies and processes as a stressed priority.

We consider it necessary to introduce industry protection measures now used in international practice in the area of industry and market protection. One of the most

important industry protection tools connected with products is to tie the import of products to standards, to health, consumer protection and environment protection prescriptions. To do this we must develop a Hungarian quality accreditation system, adjust our standards to those of the EC and introduce EC directives.... For products or countries enjoying duty concessions we must develop a strict proof of origin system like that used, for example, by the EC and the EFTA. The dumping procedure is a protective tool connected to products; regulations regarding this will make it possible to initiate market protection measures. Connected to this is the system of so-called "value equalization duties" the goal of which is to set apart, in accordance with international practice, the subsidies being paid by exporting countries.

Domestic industrial support must be implemented much more determinedly than up to now in the case of domestic infrastructural investment orders. In harmony with this, for example, we must set up as a requirement a minimal ratio (30 percent) for domestic product deliveries. If the technical content is the same a domestic bidder must enjoy an advantage if the price offered is the world market price plus 15 percent. The competition can be entered only by foreign firms which undertake to give the determined ratio of orders to a domestic enterprise or enter jointly with Hungarian firms.

Note by R. B.

What can the goal of an industrial policy program be? Participants at last week's plenary session of the Interest Harmonization Council gave quite differing answers. Employees—it turned out—consider it the government's task to work out a crisis management program. It would have to include a designation of the goals and tools needed to manage the crisis. They judged the present draft better than earlier ones from the viewpoint that it does designate concrete modalities—favorable credits, raising base capital from privatization receipts, forgiving taxes—to aid viable enterprises and undertakings make the structural and market changes. But they deplored the lack of a designation of industrial policy goals, branches to be developed and ideas pertaining to employment and training. They even recommended that the IKM [Ministry of Industry and Trade] work out a program which would contain the more important tasks according to time limits and those responsible. In contrast to this the representatives of the employers reminded us that probably this material would not even convince everyone that an industrial policy was even needed. According to them one was needed but the real question was what would be its function and what would be its tools. They disputed the idea that an industrial policy—with time limits and those responsible—would have to formulate concrete goals in the old sense. What an industrial policy should undertake is no more than the development of the economic environment, discovering the comparative advantages of the Hungarian economy for the longer run. A strategy can be built only on this. Employees and employers alike deplored the lack of protection for

domestic industry. According to them Hungarian products are at a disadvantage even on the domestic market; foreign firms, even if their goods are not much better, move better on the market. The old large monopoly foreign trade enterprises, with experience, have disappeared, and new ones have not yet taken their place.

But, as it turned out, there is not even full agreement among the ministries. The deputy state secretary for the IKM put it this way, that compared to the earlier variations they have retreated most of all in financial questions. This was the price of compromise. But they would have liked to have more money for the transformation of the industrial structure. Then the deputy state secretary for the PM [Ministry of Finance], virtually answering this question, said that the budget had no money for this purpose. And if it did it would not be right to finance the transformation of the economy from central moneys. It must be understood that today it is the behavior of the enterprises and not the earlier all-powerful state that forms economic processes.

When one considers these economic philosophy differences it seems that the question asked at the Council session is just: What will the fate of this concept be? Does it simply increase by one the list of unrealized industrial policy concepts or will it be part of some sort of united government economic policy?

To speak frankly—at least this is the opinion of the author of this note—the chances of the latter seem small.

Science Policy

92WS0759B Budapest FIGYELO in Hungarian
16 Jul 92 p 15

[Article by Peter Foti: "Science Policy"]

[Text] Science policy guiding principles were last prepared in Hungary in 1990. Now this material has been reworked again. Dr. Ferenc Madl, minister without portfolio and government overseer of this theme, emphasizes in his letter offering the document for debate that the Swedish, Korean, Finnish and OECD experiences were used in the new version. Important research priorities are formulated in the guiding principles, accompanied by less or more serious estatist dilemmas.

Personnel

In 1990—counting those employed full time—36,384 people worked in basic and applied research and development; of these the number of scientific researchers and developers—reduced to full time employment figures—was 17,550. These groups decline by about 5 percent per year, not counting the year of serious decline, 1990, when the number of intellectual workers fell by 14 percent.

In the 10 years preceding 1989 the number of those engaged in research and development (R&D) activity also declined; the so-called chained ratio moving between 1.03 and 0.88 percent. In this sphere also 1990

was the critical year, the drop reaching 14.1 percent. According to international comparisons published in a document of the Science Policy Secretariat, however, this figure for "small" and "medium" countries varies between 0.18 and 1.17 percent per year. "So Hungary, with the 0.36 percent established in 1990, was still in an acceptable range," according to the government document. The authors of the document also set it down as a fact that research personnel employed here at home have decreased more quickly in recent years, partly due to change in careers and partly due to temporary or permanent employment abroad.

The distribution of researchers and developers—in reduced personnel figures—in 1990 was approximately even between research institutes (5,189) and research sites in the area of higher education (5,204); somewhat more worked at enterprise research sites (5,681) and a smaller proportion (1,476) worked at other research sites.

In 1990, 14.8 billion forints were spent on basic and applied research in Hungary. R&D got 1.69 percent of the GDP. According to the document this relative index is still higher than the average for small and medium countries. The government experts consider absurd the earlier—1981—state of affairs when the value of domestic R&D expenditures compared to the GDP (2.49 percent) was higher than that of the United States (2.45).

Targets

It is true that since 1988 resources which could be turned to R&D definitely decreased, and this was on a greater scale than the reduction in personnel. In the two closing years of the 1980s the ratio of those performing R&D activity was 0.94 in Hungary, 0.97 in Holland, 0.84 in Belgium, 1.17 in France and 0.82 in Canada. In each of the countries listed the per capita GDP was a minimum of 6 times that of our country but at the same time, until 1989, R&D expenditures expressed in percent of the GDP were higher in Hungary than in Holland, France or Canada. At the same time the absolute value of expenditures per Hungarian researcher was always five to 10 times smaller than the international average.

As the Science Policy Secretariat sees it the long-range goal of the government in science management is to create conditions for research and development, to develop a system which interfaces with Western European intellectual mechanisms which at the same time is flexible enough to be able to follow the inhomogeneous Western European models for exploiting gray matter.

According to the document the government can think exclusively in terms of the following alternatives: It can have as its goal a fast transformation of Hungarian science, within two to three years, or it can make arrangements for longer term, five to eight year, reforms. According to the authors, however, the fast change would be accompanied by shocks which might involve the destruction of existing valuables, difficult to replace. In any case, the 5-6 billion forints which seem to be

necessary to eliminate, bring together and relocate the existing institutes and infrastructure, and create new institutes on a scale differing from the present one, are not even available. All this speaks for the rationality of a longer term reformation.

According to the proposal of the secretariat priority in the first 18-24 months should be given not to structures but rather to tasks and activities; the present rigid, often dysfunctional, institutional structures must be adapted to this. On the other hand, the branch developmental institutes, in a critical state, need to be transformed quickly, because this cannot be postponed due to the crisis situation.

Those preparing the guiding principles consider it to be the government's task in the R&D sphere to counterbalance with increased state participation the decrease in expenditures by managing units on research and development. They say that despite the low income producing capability of the economy 1.5 percent of the GDP must be turned to financing R&D.

The government regards as its obligation primarily covering the costs of state tasks—such as higher education and basic and strategic research. The basic task of the government in regard to state support for research—we can read in the document—is preservation of the viable, valuable part of the entire (basic and applied) research network, a renewal of the structure of the institutional network which will substantially improve the effective use of money turned to research. Since the Hungarian R&D sphere—as in the other former so-called socialist system countries—was oversized compared to the performance capacity of the economy, the government will undertake to keep control over the reduction in research and development personnel which is unavoidable in the course of the social-economic transformation, deliberately controlling the intellectual withdrawal cure by preserving valuable intellectual potential.

State Priorities

According to the document of the Science Policy Secretariat the primary areas of basic research belong to the main research network being managed by the Hungarian Academy of Sciences, to the universities and to the several branch research and development institutes. The MTA [Hungarian Academy of Sciences] supervises its institutional network on its own authority. But the National Technical Development Committee and the several special ministries are responsible for applied research and technical development which fits into the technology policy of the government.

One can read unambiguously from the new science policy guiding principles that the earlier intellectual traffic rules remain in effect: In research also one must yield the right of way. The MTA and the several ministries have prepared lists of their research priorities, more than one have mentioned some especially important theme to be financed.

In this document also, as in the present state of power arrangements, there is a conflict between an etatist view urging vigorous state intervention and a system of views which would apply the market to science more quickly. For example, we can read the following, with its uncertain practical outcome: "Within the given frameworks the government should give scientific research the freedom to choose problems, solve them and publish, without limiting the similar rights of other researchers or violating ethics. At the same time we cannot ignore the fact that research is financed by taxpayers who have the right to oversee the expenditures, that in every country in the world the degree of budgetary support for research is limited and research is tied to priorities, so everywhere the state plays an orienting role." So let there be compromises, the authors of the government document write.

Research priority ranking is born in the wake of serious conflicts of interest. There will now be a debate of the science policy guiding principles, and this necessarily involves a clash of interests. The compromises on the document and the priority list will show whether Hungarian science, burdened by excessive government priorities or wisely supported financially, but given permission to take wing, will serve the country in the years ahead.

TUDOSZ: "More Modern, but..."

The presidium of the Trade Union of Scientific Workers (TUDOSZ) has debated the modernized version of the science policy principles of the government. The body judged this document to be truly more modern, but it considers other approaches, stronger emphasis or alternative solutions more acceptable in places.

They emphasize that science, research, is the only domestic sphere which at all makes possible agreement with international requirements, only here is there a real competitive situation, so these sectors of the national economy must become the driving branch. And this requires a tangible expansion of material possibilities, increasing competitiveness—according to the leaders of TUDOSZ.

The trade unionists are cautious about breaking the R&D sphere into parts requiring state support and parts with a market orientation. They feel that one should consider maintaining a decisive degree of state ownership in this area, introducing non-profit management possibilities, operation as a quasi-budgetary organ, giving tax and other payment concessions.

The presidium of TUDOSZ recommends a further development of the National Scientific Research Fund (OKTA) system, an increase in the sums which can be used in this way, that the results of the several contestants be publicly accessible, and that publicity in announcing the competitions be broadened in general.

In the interest of "permeability" between universities and research institutes they recommend that researchers

and teachers be able to transfer from one to the other with their wages unchanged.

Finally, TUDOSZ urges immediate government steps to restore the prestige and attractiveness of research and teaching. Without the restoration of this prestige and possibilities for scientific promotion—they warn—the new scientific generation will again enrich only foreign science and industry.

Branch Research Priorities for Target Oriented Research (Nationally Stressed Projects)

I. INFORMATICS

- informatics and electrification
- information processing tools
- information networks
- space research (in part) Proposers: KHVM, IKM, FM, MTA

II. ENVIRONMENT MANAGEMENT

- environmental damage caused by transportation
- research tasks interdependent with state of environment and burden thereon
- forestry (wood industry), game and fish farming
- crop health matters
- environmental protection Proposers: IKM, KHVM, KTM, FM

III. ENERGETICS

- technical development in energetics (new technologies)
- manufacturing automation (in part)
- biotechnology (in part)
- technical-economic foundation for modernization of the infrastructure Proposers: IKM, KHVM, FM

IV. EARTH PROTECTION

- surveying
- mapping
- crop health matters (in part)
- space research (in part) Proposers: FM, KTM

V. FOODSTUFFS INDUSTRY

- foodstuffs processing, foodstuffs hygiene
- animal health matters
- agricultural biotechnology
- active application of biological methods (in part)
- biotechnology (in part) Proposers: FM, IKM

VI. HUMAN RESEARCH, HEALTH AFFAIRS

1. Targets proposed by the NM

VII. SOCIAL SCIENCES

1. Research concept of the OKTK

The purpose of this review is to emphasize and show that in many partial areas the needs of the several special areas are linked with one another, so these partial areas are of special importance in research.

Abbreviations:

KHVM: Ministry of Transportation, Communications and Water Affairs IKM: Ministry of Industry and Trade FM: Ministry of Agriculture MTA: Hungarian Academy of Sciences KTM: Ministry of Environmental and Nature Protection NM: Ministry of Public Welfare OKTK: National Stressed Social Science Research Projects

Source: the Science Policy Secretariat

TELECOMMUNICATIONS

Hungary: Videoton Automatika Develops Telecommunications Devices

92WS0691a Budapest MAGYAR ELEKTRONIKA
in Hungarian May 92 pp 34, 35

[Article by Csaba Egerszegi, Ferenc Simon and Gyorgy Turoczi, Videoton Automatika: "Auxiliary Telecommunications Devices Developed by Videoton Automatika"]

[Text] Two years ago Videoton Automatika began to deal with the development of devices which can be connected to landline telecommunications networks. Our initial successes encouraged us to continue to cultivate and to broaden this activity area. One of our important goals in connection with this can already be formulated rather precisely:

The creation of auxiliary telecommunications devices which can be used to make the use of telecommunications end equipment (telephones, message recorders, telefax, modems) more comfortable and convenient and with which a telephone line (or lines) can be used optimally, reducing costs.

Among other things we would like to give a positive answer—naturally, via the services of our products—to the following questions:

- Can four telecommunications terminals (e.g., telephone, message recorder, telefax, modem) be connected to a single telephone line—apparently quadrupling the line—in such a way that when an incoming call is received the call is automatically directed to the desired instrument and so that a call can be initiated from any of the devices?

- Can a single telefax set be used by two telephone lines to send a fax message on either of two telephone lines or to receive a telefax message from either of two telephone lines—apparently doubling the telefax sets (e.g., from a main line and an "extension" line)?
- Can electrical equipment (e.g., a computer) be turned on from a telephone line?

Let us look briefly at what sort of products are involved.

The EMS Electronic Call Analyzer and Call Separator Device

The EMS is capable of recognizing the calls of telecommunications devices, and of controlling the connection to line of telecommunications devices, which conduct data or speech communication via a public telephone network.

With the aid of the EMS four different devices—we suggest telephone, message recorder, telefax or computer modem—can be connected to a single telephone line.

A call can be initiated from any of the devices connected to the EMS but, naturally, only one device can be connected to the telephone line at a time.

The advantages of using the EMS really appear when handling incoming calls; the desired device is automatically connected to the line on the basis of the origin of the call.

Microprocessor controlled equipment examines the status of the line when a call comes in—for the purpose of establishing the origin of the call. It can recognize the presence of a telefax call signal (CNG signal: 1100 Hz for 0.5 seconds and a pause for 3 seconds), a calling modem signal (1300 Hz or 2100 Hz or 2225 Hz), or a two digit access code. After establishing the origin of the call it rings and then connects the called device to the line.

Telecommunications devices can also be connected to the equipment in combinations differing from that suggested.

The characteristics of the EMS, preprogrammed by the manufacturer, can be modified, or reprogrammed, according to the configuration used and the individual expectations.

It is possible to store two user programmable parameter sets, independent of one another, in the "unforgetting" memory of the EMS. For example, one may define the operating mode during office hours while the other takes care of unsupervised—nighttime—operation.

Setting or modifying the parameter set can be done from the front panel of the equipment or by remote programming by the caller.

The device counts the incoming calls and these can be displayed on a counter set by set.

Operating the equipment is simple. The required interventions can be found on the front panel and can be done

from the so-called foil membrane keyboard, from a telephone set connected to the EMS or from the caller's telephone set.

The EMS has been tested successfully in Austria and has a postal permit in (to mention their "old" names) Czechoslovakia, Yugoslavia and, naturally, Hungary (where several hundred customers have already been convinced of the advantages of the product).

EMS-MICRO

The EMS-MICRO is a cost reduced, limited service version of the EMS. It does not contain the number indicators and its factory installed characteristics cannot be changed.

EMS-PC

The EMS-PC is connected to the I/O channel of an IBM PC.

Its functions and services are basically identical with the functions and services of the basic version of the EMS. Setting or modifying the parameter sets can be done by "I/O" instructions given from the IBM PC or with remote programming by the caller.

The EMS-PC supports "journaling" of outgoing and incoming calls by the IBM PC. The "dialed" number of the called station and the number of "incoming" calls to the individual devices can be read in by "I/O" instructions.

Program packages for services which can be reached by the IBM PC are available.

EMS-2211

With the aid of the EMS-2211 four sets can be connected to two independent telephone lines—a telephone on each line and a message recorder and telefax which can be accessed by both lines—in such a way that:

- the individual telephone sets can make a connection on a line (determined by the connection) only when put into operation, to conduct speech communication, and
- the message recorder and telefax can accept an incoming call from either line and a message can be sent from the telefax on either line.

A call can be initiated from the telefax or from either of the telephone sets connected to the EMS-2211 but, naturally, only one device—per line—can be connected to the telephone network at the same time.

When a call is received from either line the microprocessor controlled equipment examines the status of the line (of the lines)—for the purpose of determining the origin of the call. It can recognize the presence of a telefax call signal (CNG signal: 1100 Hz for 0.5 seconds

and a pause for 3 seconds). After establishing the origin of the call it rings and then connects the called device to the line.

The ETS-01 Network Switch Controlled From the Telephone Line

The ETS-01 makes possible connection of residential or office electrical equipment to a single phase, alternating current grid.

Its unique feature derives from the fact that with its aid the switching on of the grid voltage can also be done via a public telecommunications network.

The ETS-01 has two operating modes:

- continuously connected, and
- controlled from a telephone line.

In the mode controlled from a telephone line the switching on of the grid voltage can be done by the ring signal arriving from the telephone line or by connection to the line of the connected telecommunications end equipment (telephone set, modem, telefax, etc.).

The switching off of the grid voltage takes place with the passage of 15 minutes following the first ring signal or with the passage of 15 minutes following the switching off of the telecommunications end equipment.

In the course of developing our products special emphasis is given to meeting domestic and international prescriptions. The devices described above can be purchased only after valid model approval, with a trade permit and with official indentifying markings.

Hungaro Digitel Joint Venture's Background, VSAT Project Discussed

92WS0691B Budapest *MAGYAR ELEKTRONIKA*
in Hungarian Apr 92 pp 3, 4

[Interview with Laszlo Martinkovics by Bela Laczko: "Interview With Laszlo Martinkovics, Representative of GTE in Hungary"]

[Excerpts] Few even in professional circles are acquainted with the American firm GTE—the largest American telecommunications provider—and we do not know even this much about its activities in Hungary. The already operating VSAT system of Hungaro Digitel aroused my interest so I looked up Mr Martinkovics for detailed information.

Laczko: Mr Martinkovics! You are an American citizen of Hungarian origin, representative of GTE in Hungary and managing director of Hungaro Digitel Ltd. Please correct me if I have formulated this imprecisely.

Martinkovics: What you have said is entirely true but I would like to supplement it a bit. Since 1986 my firm—LJM International—has been engaged in telecommunications consulting. Our central office is in Washington,

DC; we already have a branch office in Budapest and will soon open one each in Frankfurt and Vienna. Two years ago my firm signed an exclusive contract with GTE according to which we will represent their interests in Central and Eastern Europe. Our contacts are close and positive, since both of us are very optimistic about the growth of this branch in this part of Europe.

Laczko: What sort of interest could such a firm [as GTE] have in Hungary?

Martinkovics: GTE has been present in Hungary for 2 years with a broad telecommunications interest. In accordance with its experiences acquired throughout the world it knew that a task of key importance was to find the best Hungarian partners and experts. And this was done. After successful talks the firm found outstanding partners in the persons of the Instrument Technology Company [Muszertechnika Rt.] and the Telecommunications Research Institute. The third partner is the Austrian Creditanstalt, one of the most significant banks of Europe. Hungaro Digitel Ltd. (HDT) came into being in this four-way setup, as one of the first joint telecommunications ventures in Hungary. This consortium is interested in several areas of telecommunications services—radiotelephone, building up and operating private telecommunications networks, etc.

Since the radiotelephone tender has been drawn out for legal reasons HDT has concentrated on preparing and testing an experimental pilot system. This is a satellite VSAT (very small aperture terminal) system which, after getting the necessary permits, will operate a first quality private network in Hungary. We are proud of the fact that this was and is still today the only operating system the central control antenna of which is located in Hungary. The experiment is being conducted successfully with our partner, the State Insurance Agency (AB).

In addition, we regularly study the needs of Hungarian users and the possibilities of future applications. So far this system is being operated free of charge as a test service for the AB. We would like to build a complete system when the laws make this possible. This system works with the EUTELSAT satellite and is used primarily for data traffic. Audio and motion picture transmission (video frequency) will be realized in the third quarter of the year, and there is serious interest in this.

Laczko: Is GTE also interested in other telecommunications areas in Hungary? Is GTE still interested in building a radiotelephone network if a competition for this is again published here? Is GTE showing any interest in telephone service for rural districts, since this is one of its specialties?

Martinkovics: I will try to answer these questions in sequence.

We are continuing to make a detailed survey of telecommunications service possibilities and we watch with

interest the working out of the planned telecommunications law. In what area we will move forward depends on many things.

As for the radiotelephone network, naturally we would like to play a serious role on the Hungarian market if only because GTE has a successful background in this area in the USA and other countries. But there is another essential side to this question too. That is that the concession which Hungaria Telecom received from the authorities a few years ago, and which was later withdrawn, would have led to the construction of a modern digital network. CONTEL was the foreign partner of Hungaria Telecom, and CONTEL has been purchased by GTE. This firm is known in Hungary under the name Contel Hungaria.

I do not want to go into the details of this convoluted case now, I would just like to make a few observations. First, I have faith that there will be a solution which will serve the users' interests on the basis of a modern, accessible, digital system. There is a great need for such a network throughout the country. In my opinion it is a national interest that the present monopoly situation in Hungary be ended in this area and that a network based on new technology be built as soon as possible, a 900 MHz GSM system, which is the network being built throughout Europe. With such a solution Hungary would get into the front rank in mobile-cellular systems in Europe with one blow. This is a factor not to be neglected if we think about Hungary's EC membership or the 1996 world exposition. This country deserves the best which this technology can offer and I hope that we will have a chance to prove it. I myself am an optimistic man so I have faith that the present legal problems can be solved in a positive and forward looking way.

As for telephone service in rural areas, GTE is continuing to study the possibilities. In my opinion the self-governments have made important decisions among themselves to start telephone service in their areas as soon as possible, cooperating with other firms and banks, because there is a very great need for telephones on the part of the populace. But here also important legal questions have arisen which the telecommunications law must clarify. This important law, hopefully, will settle the still unclarified regulatory conditions.

Laczko: Since many have asked me, let me ask you: Will GTE stand behind Muszertechnika in these telephone companies by providing the technical and service conditions?

Martinkovics: GTE will discuss with its partners all the possibilities connected with telecommunications before making a decision. This is true also in the case of developing and operating a rural telephone network. Permit me to again emphasize the role of the telecommunications law in regard to this theme. For example, what conditions will it provide for local telephone companies to connect to the main network, what role will the new concession rules have, etc. These questions must be

cleared up before making statements about serious intentions—at least if we look at it with foreign eyes.

In my opinion these questions could be answered within a short time, which will make it possible for the Hungarian telecommunications network to meet the needs of users as soon as possible. We are ready to help in more areas too, so that these plans might be realized within a short time limit.

Hungary: Foundation for Satellite Telecommunications Created

92WS0757A Budapest *COMPUTERWORLD/*
SZAMITASTECHNIKA in Hungarian 30 Jun 92 pp 1, 3

[Article by Laszlo Tihanyi: "Hungaro DigiTel; A Hungarian Space Age"]

[Text] On 18 June Jozsef Bartha, director general of the Hungarian Broadcasting Enterprise (MMV), announced at a festive press conference that they were joining HDT with an increase in base capital. Hungaro DigiTel (HDT) was formed on 10 December, 1990, at the initiative of the Hungarian company Muszertechnika [Instrument Technology], with the participation of the Telecommunications Research Institute (TKI), the Austrian bank Creditanstalt IB AG and the American GTE. The chief goal was to spread satellite telecommunications in Hungary.

In November of last year the four raised the initial one million forints of base capital to 33 million; this has increased to 38 million with the entry of the MMV. Lajos Komar, the director dealing with Hungarian matters for the Vienna Creditanstalt, the largest Austrian financial institution, recalled that the bank was present in Hungary even at the time of the Monarchy; continuity was broken by the 1947 nationalization. Now they are returning and their entry into the telecommunications business is a good example of this.

The business is to build telecommunications networks in Hungary based on the VSAT technology. With its computer and technical experience the Muszertechnika Holding will play a key role in adapting this technology, according to Zoltan Tanko, deputy director general of MT [Muszertechnika] Holding. As for the more general problems of domestic telecommunications the HDT can rely on the experiences of the TKI in solving these, as could be seen from the words of Laszlo Talian, director of the TKI.

GTE will provide the technology. This company is the largest telecommunications undertaking in the United States and the fourth largest in the world in private ownership. They began orienting themselves here 2 years ago. Robert A. Krcelic, international director for GTE, put it this way: "The telecommunications market in Hungary offers many possibilities. If one is patient as well he can expect to get the necessary permits." It is true that at the moment the VSAT technology is hanging

between the COCOM era and legality. For the time being there can be no deal, lacking new telecommunications regulations. The situation in America is that in 1985 only a few thousand terminals were operating in the United States, now they estimate the number at 45,000 and by 1995 pessimistic estimates are counting on a hundred thousand stations while optimists are counting on twice that many. Only a fifth as many, compared to American systems, operate in Western Europe. For example, so far about 40 network permits have been issued in Germany.

The elements which give the system its name consist of an antenna a few meters in diameter, the converter head at the collection point and the "inside" electronics, the size of a suitcase. Two people can easily install one in a single day. This terminal maintains contact with the network control center at a frequency of 12-14 megahertz via the F2 synchronous satellite of the Eutelsat system launched this January. (The satellite is in a geostationary orbit at a distance of 36,000 kilometers on a line cutting the Equator and the 10 degree East meridian. If it exhausts its fuel for orbit correction it will be shot out of its obligatory position and another will be moved in, as the VSAT antennas are aimed there. The satellites of GTE itself, of course, can be seen from America, which is why they have to use the Eutelsat satellites.) It is true that this automatically causes a delay of a few tenths of a second in the data traffic, but this is not a problem. The delay in traditional packet switched network applications, for example, is several seconds! Terminals numbering from several tens to several thousands can be connected to one center. (According to HDT experts it would be economical to build a network control center even for only 200 terminals.)

The first Central European model network has been operating its own network control center for five months in the Kinizsi Street computer center of the AB [State Insurance] Aegon Insurance Company. The task of the system is to exchange computerized data on automobile insurance between insurance offices; it connects Budapest with Szolnok and Szekesfehervar. At present the center can be connected to seven computers but in case of need this number can be increased virtually without limit (by eights). (Naturally common telephone lines are not suitable for such connections.)

It transmits 91 percent digital signals, 5 percent analog and digital video signals and only 4 percent speech; these are the world statistics for VSAT data traffic. (It does not pay to chatter via satellite.)

So what do they use the VSAT system for in America? GTE plays a leading role in the telecommunications systems of the government and defense. (The HDT probably has similar ambitions.) For example, this firm served such needs of the allies in the Gulf war. The value of their own nine satellites is one billion dollars. GTE operates a number of networks some containing several thousand VSATs. For example the Kmart department store chain organizes its bar code system with a VSAT. Here is a striking example of what it means from the

business viewpoint to have a network consisting of a small number of highly reliable elements in a crisis situation. In September, 1989, hurricane Hugo rendered the traditional networks of the banks inoperable for days. A European can hardly conceive of what this means for Americans, living without cash, on their credit cards. But the VSAT system of the First Union Bank was already operating two hours after the blow fell.

Naturally a highly reliable network (in which even an exchange of satellites causes a downtime of only a few seconds) is also very discreet. Beyond the segregated aspect of the network and the secrecy procedures of the user himself an additional security level can be built into the system as a special service.

Laszlo Martinkovics, business chief of HDT, is not worried about competition but is counting on an honest business struggle. This will happen because others also have an eye on the satellites (let us think only of the similar aspirations of Matav [the Hungarian Telecommunications Enterprise] and Banknet).

Hungary's Telecommunications Development Presented

Muszertechnika Regional Plans

92WS0758a Budapest **MAGYAR ELEKTRONIKA**
in Hungarian Jun 92 p 3

[Article by Miklos Halasz, Muszertechnika Company: "Goals of the Muszertechnika (Instrument Technology) Company in Development of Regional Telecommunications"]

[Text] The telecommunications backwardness of our country is a serious inheritance which to a large degree holds back the economic development of the country and the development of quality conditions for human life. The telecommunications monopoly hinders progress—because there are insufficient central resources for the necessary fast development. Recognizing this, both the legislature and the administration have decided on a new regulation for telecommunications, putting an end to the monopoly situation.

In the hope that market relationships may develop in the area of telecommunications as well the leadership of the Muszertechnika Company (MT) decided to extend their activities into the telecommunications sector too.

MT took as its goal intensive cooperation in the development of regional telecommunications in areas which do not figure in the developmental plans of MATAV [the Hungarian Telecommunications Enterprise] in regard to the near future. MT recognized the tensions and unsatisfied needs characterizing settlements throughout the country in regard to phased telecommunications development and so, in the summer of 1991, established contact with a number of self-governments to develop and realize modern telecommunications systems for the affected areas.

In the course of preparations we hoped that the new telecommunications law, taking into consideration the observations and modifying proposals submitted, would be accepted within a few months and would not be an obstacle to starting real work.

As a result of the prolongation of approval of the telecommunications law the telecommunications development of the affected areas—awaited with justified impatience—has been postponed further.

MT wants to achieve the most far-reaching good working contacts and cooperation with the local and central organizations of MATAV, as the authorized provider at present. This desire has been expressed in direct talks too. Cooperation in regard to indirect, regional development consists of the following:

- we will adhere to the MATAV prescriptions in addition to the international standards,
- the networks to be set up will fit into the plans of MATAV (the long-range plan up to the year 2000, the accelerated 3-year program and the village program),
- they will be connected to the nodes of the national digital telephone network,
- they will accept the secondary and primary system main exchanges selected by MATAV and we will develop compatible subsystems accordingly, and
- they will adopt the network technology of MATAV.

In establishing regional networks we will strive, insofar as possible, to build a complete primary level in each case. At present telecommunications networks for eight complete primary regions and four primary areas figure in our plans but self-governments of additional regions continue to make inquiries.

Our preparations would make possible the creation of about 450,000 main telephone lines for about 430 settlements by 1994. Even in the initial phase we will strive to create a buyer's market for telephones so, depending on the size of the settlements, we will take initial connections into consideration, naturally with regard to the regional development ideas and the development of the population. This will cover:

- 30 percent of the dwellings in areas with fewer than 2,000 inhabitants,
- 35 percent of the dwellings in areas with 2,000 to 5,000 inhabitants, and
- 40 percent of the dwellings in areas with more than 5,000 inhabitants.

We will satisfy 100 percent of the public facility demand in the first phase of construction.

A buyer's market will make it possible for us to plan digital exchange capacity with 50 percent reserve over

known demand; the trunk line will be capable of satisfying 120 percent of the dwellings (140 percent in very large settlements where there are many public facilities).

In regard to traffic we are counting on the following average (specific) figures:

- residential phones, 30m Erl/alls. [calls per station],
- public facility main phones, 100m Erl/alls.,
- subexchange main phones, 250m Erl/alls., and
- public [coin] phones, 150m Erl/alls.

When developing regional systems we have in mind digital solutions and in general, depending on location, a ring network topology in the interest of modernness, reliability and uniform service. Single mode light conducting cables, 1,300 nm, and in some places microwave point-to-point small distance connections will form the basis of the regional connecting network.

Use of digital switching technology and a PCM hierarchy will make possible fast connection and transmission, a high degree of unsupervised operation and the creation of network monitoring and controlling systems in the interest of quality service to users. Remote switching stages and sometimes autonomous exchanges will be connected to the primary exchange for the area. In consideration of the two basic switching systems selected by MATAV, the Ericsson AXE and the Siemens EWSD exchanges, the basic subscriber modules will be built as 128 and 12 line units respectively.

Transmission technology will be so constructed that the multiplex equipment will be suitable for transmission of both fiber optic lines and wireless microwave connections, realizing connections with speeds of 2, 8, 34 or 140 Mbit/s depending on the structure and the location of the connection. In some cases subscriber PCM equipment will be used, in two, four or 30 channel versions.

In addition to telephone service the network to be built will be suitable for complex telecommunications services such as data transmission, value added services, operating security systems and broad use of cable television and for satisfying, in quality and quantity, every need which may arise in the future.

Computer programs compiled by MT will aid optimal development of the regional networks. The networks will be set up by the prime contractor MT Telecom Ltd. and, bringing in subcontractors chosen by competition, they will be ready to go and training can be provided if desired.

The Muszertechnika Company maintains continual contact with domestic and foreign telecommunications organizations, suppliers and a few training centers so that it has up-to-date information and is ready to serve users at a high level.

Kontrax Telecom's Role

92WS0758B Budapest MAGYAR ELEKTRONIKA
in Hungarian Jun 92 p 6

[Interview with Gabor Huszty, managing director of the Kontrax Telekom Company, by Bela Laczko]

[Text] Our readers certainly know that the First Pest Telephone Company has been formed. The goal in founding the company was to see that everyone in three districts—districts at a low level in regard to telephone supply—should get a telephone in a short time and indeed to develop a buyer's market. This undertaking, a model in many respects, raises a number of questions so we looked up Gabor Huszty, managing director, who tried to give an exhaustive answer to every question.

Laczko: Mr. Huszty! I have many questions in connection with the First Pest Telephone Company which are, primarily, of an economic and technical nature. As an introduction, please briefly summarize the facts!

Huszty: The founders of the First Pest Telephone Company are Kontrax (37 percent), MATAV [Hungarian Telecommunications Enterprise] (32.5 percent), the three district self-governments (5 percent) and the populace. The 2 billion forints of base capital were created by the subscribed shares; the company started with this. The sale of shares was more successful than expected too. The populace could subscribe to shares at the branches of the Postabank and subscription was closed before the planned time limit because the shares had been "used up" and oversubscription was not possible. Since those telephone customers who are share holders enjoy priority in getting hooked up the purchase of shares unambiguously indicates the desire of the populace for phones.

Since then the company has been "spending the money," it has begun operation. Since a feasibility study was prepared before the company was founded we are now at the stage of buying premises and we will soon begin construction.

Laczko: Before we turn to technical questions let me ask one more question of an economic nature, What is the planned cost of the whole investment, and where is the money coming from?

Huszty: The total investment will come to roughly 5.5 billion forints. We prepared a financial plan as part of the investment schedule and we are proceeding accordingly. When the 2 billion is used up we must be at the stage of beginning to hook up lines, for which subscribers will pay an entry fee. This will give the company a new income. Naturally we will need credit too; here we are thinking primarily of foreign lenders.

Laczko: You do not plan to bring in foreign capital?

Huszty: Yes we do. We consider this possible to an economically justified degree. We have already taken the initial steps. With gradual hookups the company will get more and more subscribers. We think that by the end of

next year we will hook into the network, with an expected 94,000 subscribers.

Laczko: I would like to ask why the first company was formed in just these three districts (X, XVII and XVIII)? I imagine there are both business and technical reasons for this.

Huszty: When we first talked with MATAV in March and April of last year we asked them to designate an area where it would be advantageous for them also if we created a telephone network. We had economic calculations which showed that the investment would not be economical with fewer than 30,000 subscribers. It was also important that it be an industrially developed area (with public area subscribers). At the same time we wanted to set up a "model" network, that there be an industrial area, apartment dwellings and single family homes in the area. Each meant different conditions so we would be able to learn which solutions were most economical and which solutions were most effective technically. So the choice fell on the Kobanya-Rakoskeresztur-Pestszentlorinc area, where all these things can be found, including two large area institutions—the Airport and the Fairgrounds. There are already 30,000 subscribers in the area and about the same number have been waiting for phones for years, so there is enough solvent demand to guarantee that the network will be used. Indeed, thinking of the future we will install, for example, the Ericsson exchanges so that they will be able to serve 160,000 subscribers in their final versions.

Laczko: Let us turn to technical questions. What solution did you find optional in this most "mixed" area?

Huszty: Technically the first question was, one exchange or several? There is not a 160,000 line exchange anywhere in the world so clearly there must be a reason for it because any large manufacturer could make one, in principle. One reason is that it is strategically disadvantageous, if anything happened to the exchange then telephone service to a large area would be paralyzed. The other reason is operability; clearly a giant exchange raises many such problems.

So we think we will solve the switching technology problems with 3 large exchanges and 29 outlying subscriber stages. These will be linked by an optical fiber ring. Economically this solution gives the advantage that, on average, 1.5 km cable will have to be laid to connect each subscriber. This will result in an investment costs saving of about 20 percent.

Laczko: The last question: If this is the First Pest Telephone Company then will it soon be followed by the Second, and so forth?

Huszty: This name was recommended primarily by our friends at MATAV. According to our present plans the next company—to be established by us—will not be in Pest but in Szabolcs-Szatmar-Bereg county. I cannot say

more about this now. A month from now we would like to make the details known to those interested.

Packet Switching Expansion

92WS0758C Budapest *MAGYAR ELEKTRONIKA*
in Hungarian Jun 92 p 55

[Unattributed article: "Expansion of the National Packet Switched Data Network"]

[Text] There is more and more talk about data transmission these days. The financial institutions, banks, insurance companies, national institutions, offices, state administration, education and health facilities with extensive networks and a number of areas of the economy, trade and science need suitable links for their computer tools, far from one another, and their distributed computer applications, with both their domestic and foreign partners.

Of the various possible solutions it is the data networks, and the packet switched data networks therein, which have shown the greatest development in the past decade in those countries which lived through the present domestic situation years ago.

By the middle and end of the 1980s packet switched data networks were operating in almost every developed country and in a number of developing countries, a number of them with international connections.

Today these networks, like the telephone or telex networks, constitute a world scale network, creating possibilities for the international linking of computers and applications.

The secret of the success of packet switching is a number of properties, deriving from the packet switching technology, which offer solutions to a significant number of the earlier problems of users.

In packet switched data networks the information is broken down into parts of uniform size and moves in packets. Basically, this procedure also makes possible communication between terminal devices which have different speeds, error free information transmission, and multiple, optimal use of the transmission paths of the network.

The standard gateways of the network create connections with other types of data stations operating on line switched data, telephone or telex networks.

Among the additional advantages of a public network we might mention the fact that a very extensive network has greater reliability than a smaller private network and that the development, expansion and operation of the network, according to need, is the problem of the provider.

Packet Switching in Our Country

A public packet switched data transmission service started in 1989 with tools developed domestically. The

system, started to satisfy the needs of a closed user circle and later developed into a public network, could be expanded on a larger scale after resolving constraints pertaining to developed technology.

Already connections can be made through the network with almost every country of Europe and with a number of networks in the United States. Access to additional countries or networks is taking place continually.

The network has a gateway into the switched telephone network and the line switched data network, thus increasing possibilities for using it and expanding a fuller response to needs. An expansion of the number and quality of network gateways (calling in or out, the X.32 procedure, new speed categories, error protection procedures) will take place this year.

On the basis of a MATAV-Siemens contract signed on 18 October, 1990, a national level, qualitative and quantitative expansion of the packet switched data network began in 1991. Full implementation of the system takes place in three phases. In the first phase EWSP centers were set up in Budapest, Miskolc and Debrecen, to a value of about DM3,250,000, and a central monitoring system for the network was built in the building of the Telegraph and Data Transmission Authority in Budapest. The equipment was handed over at the end of 1991.

During the second phase smaller centers (ANP, HNN20 type) were installed in an additional 17 cities—Sopron and the county seats.

The total value of the second phase—in which we installed transmission technology equipment in the Budapest telephone exchanges as well as in the centers—was more than DM5,640,000.

The first two phases together provided a capacity of about 1,200 ports (direct connection possibilities).

In the third phase of the contract—it has a value of about DM12,370,000—the already operating centers will be expanded and three more centers will be installed, by the end of 1993.

Together the three phases of the expansion provide a capacity of 3,000 ports, which we will put into operation at a pace corresponding to demand.

The Hungarian Telecommunications Enterprise [MATAV] assumed domestic bank credit for 15 percent of the total contract DM21,257,000. Siemens provided the enterprise with company credit for the additional 85 percent. Repayment of principle and interest will take place from 1990 to 1999.

The total planned cost of the investment—which will probably increase because of the multiple devaluations of the forint since the contract was signed—is about 1.4

billion forints. The total for the investment may appear relatively modest compared to the large basic network and telephone network investments of the Hungarian Telecommunications Enterprise.

Its significance is shown primarily by the fact that a national network at the European level, meeting international standards (X.25), optimally supporting almost every application of remote data processing—a network which, in addition to providing the infrastructure necessary for data transmission, may also be a carrier network for additional value added services—greatly increasing the performance of computer tools isolated from one another, by creating a possibility for communication, is already an organic and indispensable part of the economic circulation. The fact that up to now a number of

financial institutions, offices with national networks, enterprises and undertakings and mixed enterprises and representative agencies with several sites have applied for about 600 direct connections well reflects the importance and significance of the investment. In addition to the some 450 present users of the network—of which more than 300 access the packet network directly, the rest doing so from the switched telephone network or the line switched data network—we are counting on an additional 800 users by the end of the year.

Flexible realization of the third phase of the investment will make possible satisfaction of all already known and additional needs and it is our intention to use special line supplementing solutions where traditional network solutions are not yet available.

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